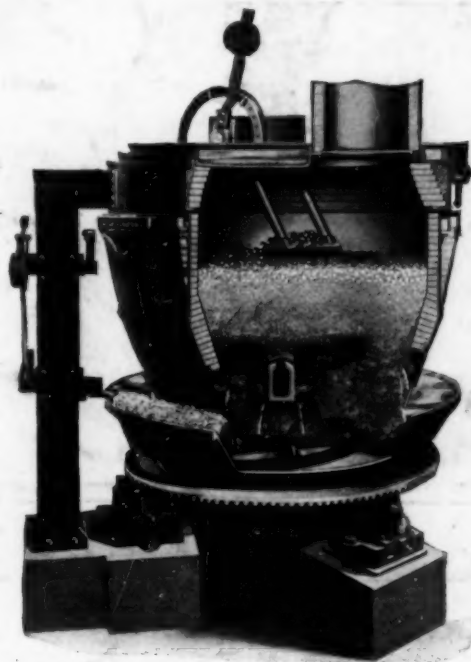


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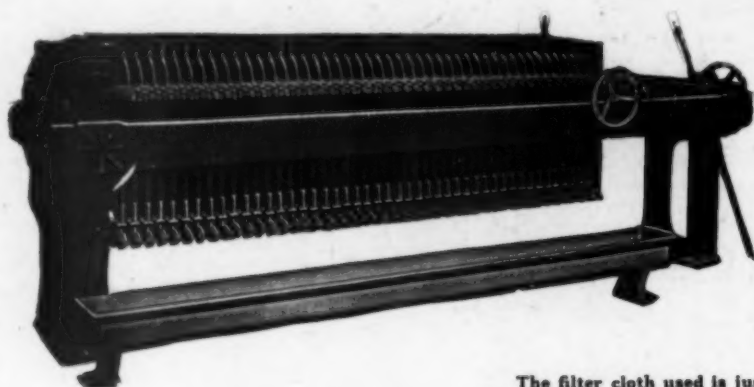


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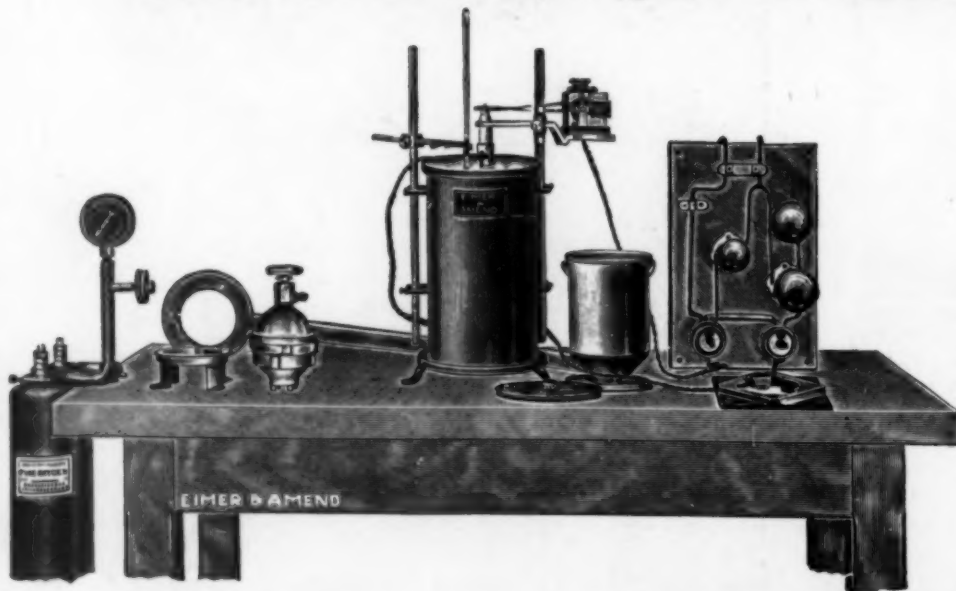
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CHEMICAL & METALLURGICAL ENGINEERING

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H. C. PARMELEE, Editor

Volume 28

New York, February 21, 1923

Number 8

The Chauffeur Aspires

A GOOD reputation achieved through laborious effort and sheer merit has always been the envy of the near-worthy and the goal of the covetous. Those who are on the fringe of importance or greatness or distinction or respectability like to persuade themselves that they are, in point of fact, quite within the fold. And so it happens that periodical assaults are made on the citadel of engineering by various crafts and trades, conscious of the good name and reputation of the engineer and seeking as a trophy the use of the word "engineer" in describing their vocations. The plumber would be a sanitary engineer, the fireman a fuel engineer, the tailor a sartorial engineer, the barber a tonsorial engineer, and so on with the butcher, the baker and candlestick maker.

And now comes the chauffeur. A recent item in New York papers records the organization of chauffeurs into the Society of Professional Automotive Engineers. There is a slight distinction in the name from that of the well-recognized Society of Automotive Engineers, which is one of the great national engineering bodies. But undoubtedly the distinction, though slight, is significant in the minds of the chauffeurs. They, be it known, are *professional* automotive engineers while the others, forsooth, are doubtless only amateurs. Our new aspirants for engineering recognition probably look upon themselves as very *practical* men, while such theorists as produced the Liberty motor or who now design modern automotive mechanism are mere academicians. But there is a further distinction. We learn from the news item that "There is a great difference between an automobile driver and an automotive engineer." So there is; but not the one the reader has in mind. We learn further from the president that: "Our organization is composed of professional operators of automobiles in private employment. It aims to place the profession on a higher plane and to protect its members from increasing laws levied on operation of automobiles." We quote from the interview without editing. And we learn that taxicab drivers are not eligible for membership, while the lowly commercial truck driver is not even mentioned. Evidently the "great difference between an automobile driver and an automotive engineer" is principally one of vehicle. One has to sit at the steering wheel of a limousine in order to be eligible to the Society of Professional Automotive Engineers.

For the moment we can think of no title or designation that has suffered more from illegitimate use at the hands of aspiring craftsmen, unless it be that of "professor." Who used to make the balloon ascension and parachute drop at the county fair in the old days? None

other than our old college friend Professor Blimp. And who now presides over the local parlor for manicuring and chiropody? Professor Foote, of course. Who teaches dancing, if not Professor Tango? And is not the favorite headliner on the vaudeville bill frequently Professor Aladdin with his black art? Finally there has been no more chronic aspirant than Professor Bump, the phrenologist. Small wonder that this title has almost fallen into disuse among those who earn and deserve it.

Reputation has been the theme of some of the finest gems of literature. We immediately recall the plaint of Iago in "Othello," when he says, "Who steals my purse steal trash . . . but he that filches from me my good name robs me of that which not enriches him and makes me poor indeed." Again he says that it is "Oft got without merit and lost without deserving." And in "Richard II" *Mowbray* says that without spotless reputation "men are but gilded loam or painted clay." We presume that the chauffeur will not be the last to filch the name and reputation of the engineer with which to gild the loam or paint the clay of his humble but useful calling. Nor have we any formula for preventing encroachment on the proper use of the title. We protest against it, but evidently it is something which, like the poor, we have always with us.

Another Problem For the Fertilizer Industry

IN OUR issue for Jan. 10 we published an editorial entitled "Long-Term Credits in the Fertilizer Industry." Some of the discussion which that editorial called forth has already appeared in Readers' Views and Comments, but we believe there are several points that are worth further emphasis. Perhaps the most significant has to do with the marketing of fertilizer. Certain localities seem to have become a kind of dumping ground for fertilizer. Perhaps they do not consume enough material to be classed as a field of major sales activity, but apparently they are the happy hunting ground for the disposal of surplus stocks of various kinds. "Sell at cost or even below, but sell anyway!" That is evidently the slogan.

What results is a veritable orgy of competition. A contract is signed with one salesman. Another calls who offers a better price. The customer then calls up the first company and demands a lower price or cancellation of the contract. Or, worse than that, he does not even notify the first company but buys from salesman No. 2. In a buyer's market the seller can do nothing but grin and bear it. If he sues he will lose a customer. So the net result is that contracts amount to nothing. The same is true of the price list.

Several solutions have been suggested. One is to

make consumption and production balance in the industry, either by controlling production or by increasing consumption. Of course the former is impossible except by a now illegal combination of producers, and the latter is a much-desired and sought-for end. It might, however, prove somewhat of a boomerang, for increasing demand would probably lure others into the field of production. The more practical solution is that of insisting through the National Fertilizer Association that contracts and sales agreements be strictly enforceable. It is distinctly within the power and province of the association to work for good business practices. It would be a principle easy to enforce through such an organization. No one is the gainer from present conditions except possibly the consumer and at the sacrifice of one of the cornerstones of business.

What's in The Ruhr?

SIX weeks ago Germany's largest and most tangible asset was the great industrial district lying in the valley of the Ruhr. Before its occupation by the French and Belgian troops, it was a principal source of coal, the seat of a tremendous iron and steel industry, the heart of Germany's industrial system. Today, production in that district is practically at a standstill. No man can predict the ultimate result of the French occupation nor its effect on the world's economic structure.

In the belief that more information about the economic and industrial aspect of this situation would be welcomed by our readers, an editorial survey has been made of available economic data bearing on the Ruhr district. In another place in this issue there will be found an attempt to answer, from a chemical and industrial viewpoint, the important question, "What's in the Ruhr?"

Notwithstanding present uncertainties in the situation, there have been a number of developments and apparent tendencies that are gradually helping to crystallize sentiment in this country and to aid in our appraisal of what the situation portends. For one thing, it is becoming increasingly apparent that the policy and plan which has guided the French is not one that will be consummated by the developments of a week or month. It is the building of a permanent structure, organizing for the long swing rather than for the immediate profit. This attitude is beginning to be shown in a number of ways, such as the strategic control of traffic with the idea of exacting taxes and tariffs. The only definite attempts so far to demand reparations in kind have been in the case of coal—which is, of course, merely the justifiable collection of a debt long overdue. The attitude toward the chemical plants has been less discernible, but underlying it is this same long-swing policy. Incidental interferences such as the confiscation of specific shipments of raw materials have been reported, it is true, but this can scarcely be regarded as the permanent plan. The coal-tar crudes and intermediates needed by the German dye industry will not find a ready market elsewhere, and for taxable purposes it would seem more logical that they be allowed to pass into consumption and taxes enacted on the finished goods—i.e., the dyes and reparation products already demanded by France and Italy.

But the most important tendency to become evident—the real riddle of the Ruhr—is the great political problem in bringing together in a workable unit the

German interests of the Ruhr and the French interests of Lorraine. As long as the one controls the coal and the other the iron ore, they stand at loggerheads. To revert to pre-war conditions, with one country in command of both resources, would seem to be the first requisite for production. But it is evident, too, that insurmountable difficulties will crop up constantly in any co-operative arrangement in which France is the employer and Germany the worker. Therefore, it is obvious that peaceful economic settlement can come only with a solution of the political difficulties. To hazard a guess as to the effectiveness of the proposals of the separationists is perhaps immature, but it would seem that at times the coming of such an event is already clearly foreshadowed.

How is this trouble in the Ruhr going to affect us? Temporarily, at least, we are more likely to be benefited than harmed. Our export trade in foodstuffs and raw materials will probably suffer because of the district's loss of purchasing power, but this will undoubtedly be more than compensated by the gain in our exports of manufactured goods, of iron and steel products, and of similar commodities originally supplied by the industries of the Ruhr.

Our own organic chemical industries, as Dr. HERTY has pointed out with characteristic forcefulness, have fortunately insured us against a recurrence of the tragedy of 1916. We are prepared to supply the American consumer, or the world if necessary, with practically every dye and coal-tar chemical required for uninterrupted production. For the economic good of the world, it is to be hoped that the industrial prostration of Germany can be averted, but it is comforting to know that we are prepared for such an emergency if it does come.

Winged Errors in Chemical Literature

WHEN we chemists get hold of an error it often takes more than a mental crowbar to pry it loose from us. Start a wrong constant in a textbook and there it is, not only in that book but in nearly every one that comes afterward. Of such a defective record a chemist told us the other day that he had looked it up in three different textbooks, and since they all agreed he thought they must be right. But they were all wrong.

A few days ago in discussion with Professor KENDALL of Columbia, who is reviewing the textbooks of the late ALEXANDER SMITH, he referred to the melting point of ammonium sulphate as one of those winged errors that fly through the literature. It seems there was a Frenchman who had worked with ammonium sulphate and developed the facts back in the eighteenth or thereabout, and he published his findings, which were correct, in his book. Next somebody else wrote a textbook which became more popular and he was a bit hasty about getting the data on ammonium sulphate, or he may not have read French very well. At all events he put down the melting point as 140 deg. C. and there it started. Everybody else copied it, and now it is standard in the literature.

In point of fact, if ammonium sulphate is heated in a closed tube it does not melt until above 600 deg. C., whereas if heated in an open tube ammonia is given off, the acid salt is formed and it is the acid salt and not ammonium sulphate that melts at 140 deg. C.

The Psychology of Glass As Plant Equipment

THOSE who read Mr. MARSHALL'S interesting contribution on industrial glass in our issue for Jan. 31 must have been struck with the note of practical psychology that he sounded with respect to the use of this material in chemical plant construction. The very quality of glass—fragility—which might be expected to defeat its use as a material of construction has proved, in the case of Pyrex, to be the best insurance against breakage.

We have all grown up in the knowledge that glass is breakable, and this fact is connected in our minds with its quality of transparency. Of two pieces of apparatus, one of transparent glass and the other of opaque earthenware, there would be no question in the mind of a workman as to which he must handle with care and respect for its fragility. Earthenware looks tough and no amount of experience with breakage in clay products would give him the same instinctive respect for it that he would have for transparent, fragile glass. Consequently, although breakage might be expected to be high in plant apparatus made of glass, the reverse is found to be true, because a workman anticipates the likelihood of breakage and handles the transparent material more carefully.

While we can scarcely advocate the extension of this interesting example of psychology to the point of advising that plant apparatus be made fragile instead of rugged in appearance, we think that it does furnish one of the best evidences that glass has by no means reached its full utility as a material of plant construction. Its transparency is one of its greatest merits, and apparently its fragility is by no means the drawback that might have been expected.

An Opportunity For the Tanning Chemist

THERE is a good deal of talk going on about the destruction of wild animals for the fur industry. Until 10 or 12 years ago the wild birds were being killed to such an extent for feathers to decorate women's hats that Congress took measures to stop it, and these were successful. Now we have no brief to present on behalf of moles, squirrels, skunks or muskrats, which are threatened with extermination; we never cared for minks or weasels or foxes around the chicken yard—in fact, we have not yet added the salvation of fur-bearing animals to the reforms we support.

We are, however, always ready to join in any reasonable effort to eliminate rats. They threaten us with disease, they carry the bubonic plague and they are a nuisance to the whole world. Once, years ago, we ventured to suggest editorially that rat skins be tanned and brought into use, but this instigated such an amazing correspondence that it nearly got us into trouble. Nevertheless, we venture again to attack the subject from a somewhat different angle and to call in the aid of chemistry.

In regard to clothes, men wear what their tailors and their wives tell them to wear, so long as their raiment shall be without any distinguishing mark of individuality. Women think more about their clothes than men do, they aspire above all things to be in style and every woman wants her clothes to be "individual" in cut, in trimming and in fabric. But if anybody had told us

when we were boys that women would be straining every nerve to possess and wear the skins of skunks, we should not have believed him, although today these very skins are a luxury.

Now rat skins make good leather. The pieces, of course, are small. What is called for is an advance in the art of tanning and in the discovery of a method of joining the edges of the separate pieces by some colloidal turn. Granted that such a material may be produced that is pleasant to wear and durable, we may expect it to become fashionable. Any amount of expense may be added to it by trimming, but even when worn plain, the wearer will achieve merit by encompassing himself or herself in a garment made of it.

Soft leather coats, vests and overcoats are very desirable for men in cold weather, and if they are in fashion women may be trusted to wear them, even in the hottest summer days if the Paris dressmakers should decree it. The main thing is to produce the material, and only a chemist familiar with the technology of leather can do this. The development of such an industry would make the destruction of rats a profitable enterprise—and that would be the end of one of the worst pests of our day and generation.

A Discriminating Benefaction to Science

CHEMISTRY in the West, professional and industrial, will be heartened by the news of a princely gift of over \$4,000,000, by ARTHUR H. FLEMING, of Pasadena, to the California Institute of Technology—an act that marks a significant advance in the scientific life of the Los Angeles district in particular and of the Coast region in general. Such a gift is an indication and an appreciation of the vigorous growth and promising vitality of those Western industries whose prosperity depends in large measure on the provision of a sound scientific foundation and the unremitting application of technical research.

Benefactions often fail in their purpose because of a lack of discrimination and foresight on the part of the donor. It is refreshing, therefore, to note that Mr. FLEMING accompanies his gift with suggestions that should receive the careful consideration of all who are concerned with higher education. He earnestly advises that the California Institute limit its enrollment to 2,000 students; this we may interpret as an indorsement of the contention that mere bigness too often connotes emptiness. He recommends that the Institute "specialize in chemistry and physics, under the direction of the most competent men available, with the most liberal provision in the way of salaries and equipment, for the prosecution of such work; that it seek and invite the superior student; that it help and encourage those who are disposed to research, but that the utmost care be exercised in the manner of giving such help and encouragement, keeping always in mind that ill-advised or too free-handed assistance begets weakness rather than strength, and that a man should be helped to help himself."

With such a code of common-sense ideals, and with the financial support of public-spirited citizens such as Mr. FLEMING, the board of trustees of the Institute needs no more than competent scientific direction and the co-operation of the earnest student to insure for California an eminence in technology commensurate with the needs of her rapidly expanding industries.

Readers' Views and Comments

Dühring's Law Of Vapor Pressures

To the Editor of Chemical & Metallurgical Engineering

SIR:—There appeared in the Jan. 24 issue of your journal an article entitled "Theoretical Derivation of the Vapor Curve of Xylol." In this article there is presented what is termed a "novel" method of calculating the vapor pressure. I wish to call your attention to the fact that this method was probably first proposed in 1878 by Dühring, and has since appeared in most of the textbooks on physical chemistry, either under the name of Dühring's relation or as a special case of the more general Ramsay-Young vapor pressure relation. Furthermore, this same method of calculating vapor pressure has appeared recently in *Chemical & Metallurgical Engineering* in the articles by W. L. Badger on the properties of salt solutions. A recent article in the *Journal of Industrial and Engineering Chemistry* (vol. 14, No. 6, page 569, 1922) also called attention to this relation for the calculation of the vapor pressure of certain hydrocarbons derived from coal tar. In view of these facts I cannot but take exception to the statement that this is a novel method for the calculation of vapor pressure.

BARNETT F. DODGE.

Newtonville, Mass.

Problems in Sodium Sulphide Manufacture

To the Editor of Chemical & Metallurgical Engineering

SIR:—Your article of Jan. 10, together with the interesting letter of Mr. Hart on "Problems in Sodium Sulphide Manufacture," has mentioned in a way the manufacture from salt cake and from barium chemicals. However, the process which I have developed here I hope will be sufficiently interesting to warrant a note.

We are using niter cake which we charge directly into the sodium sulphide reverberatory type furnace along with 20 to 30 per cent gas-house carbon. The reverberatories are oil fired. The reduction is carried on until approximately 70 per cent of the available Na_2SO_4 content is reduced to Na_2S and is then tapped from the furnace. This charge, after cooling, is ground and dissolved, giving a solution containing sodium sulphide, considerable proportion of Na_2CO_3 , Na_2SO_4 , $\text{Na}_2\text{S}_2\text{O}_3$, etc. This solution is filtered and barium sulphide added to complete precipitation. The precipitate settles rapidly, the supernatant liquid being decanted directly to the storage tank for the sodium sulphide evaporator. The precipitate, after settling, is filtered over an Oliver filter, then goes to wash tanks. After several washes removing the small amount of sodium sulphide remaining, sulphuric acid is added until all of the precipitate is converted to BaSO_4 , or blanc fixe, and is sold as a standard article.

The chief features in this process are that what is not converted in the furnace to sulphide is later on converted by the addition of barium sulphide, giving a very pure sodium sulphide solution for evaporation and a high-grade blanc fixe as a byproduct. Moreover, by operating at a lower temperature and not endeavoring to secure

such a high-grade sulphide in the furnace, the life of the furnace is more than doubled. The furnaces used have a hearth area of about 160 sq. ft. and produce about 6 tons per day of concentrated sulphide, 70 per cent of which is from the direct furnace reduction, the other 30 per cent from the barium sulphide precipitation.

Metal and Chemicals Extraction Co.,
Oakland, Calif.

B. T. ROCCA.

Rapid Sorting Of Alloy Steel

To the Editor of Chemical & Metallurgical Engineering

SIR:—Having had occasion recently to sort a badly mixed stock of bar steel, I attempted to use the method described by M. Galibourg in your issue of Nov. 15, 1922, p. 992. This consisted in measuring the thermal emf. against pure iron wire, when the ends were immersed in a pot of warm mercury.

Our tests did not indicate that it is possible to use this method on a commercial scale. There is undoubtedly a difference in the emf. force for different analyses, but this is in fact so slight that we could not rely upon it. The results we obtained follow:

Steel	Temperature Deg. F.	Millivolts
Utica oil hardening steel.....	250	0.6
Swedish iron.....	248	0.2
Halecomb toolsteel.....	248	0.9
Ketos oil hardening steel.....	252	0.5
Clarite high-speed steel.....	252	0.25
S.A.E. 5120 steel.....	252	0.1
Machine steel.....	250	0.1

The suggestion in the article of using Brinell test was not carried out, but this will not make any material difference. The Brinell hardness of for instance the last two steels will at least under certain circumstances be similar and as the emf. is the same, it would not be possible to separate these two steels by this method. We realize of course that in other special cases it might be possible to use this method to advantage.

E. W. EHN,

Canton, Ohio.

Metallurgist, Timken Roller Bearing Co.

Long-Distance Hauling of Sulphuric Acid No Longer Feasible

As the transportation of sulphuric acid for long distances is difficult and expensive, the producing plants are located close to the points of consumption. Prior to the war a 200-mile haul for a regular contract delivery of acid over a long period of time was exceptional. Under the unusual conditions that prevailed during the war, the acid was shipped even from the Pacific coast to New York, but since the resumption of normal business, it is now hauled for only comparatively short distances. Moreover, few cargo boats are equipped to transport sulphuric acid in bulk and its corrosive action on metal containers makes it subject to high insurance and freight charges. There is, therefore, little international trade in the acid. Of the 6,407 tons exported from the United States in 1921, 2,895 went to Mexico, 1,389 to Cuba, 722 to Argentina and 110 to Canada.

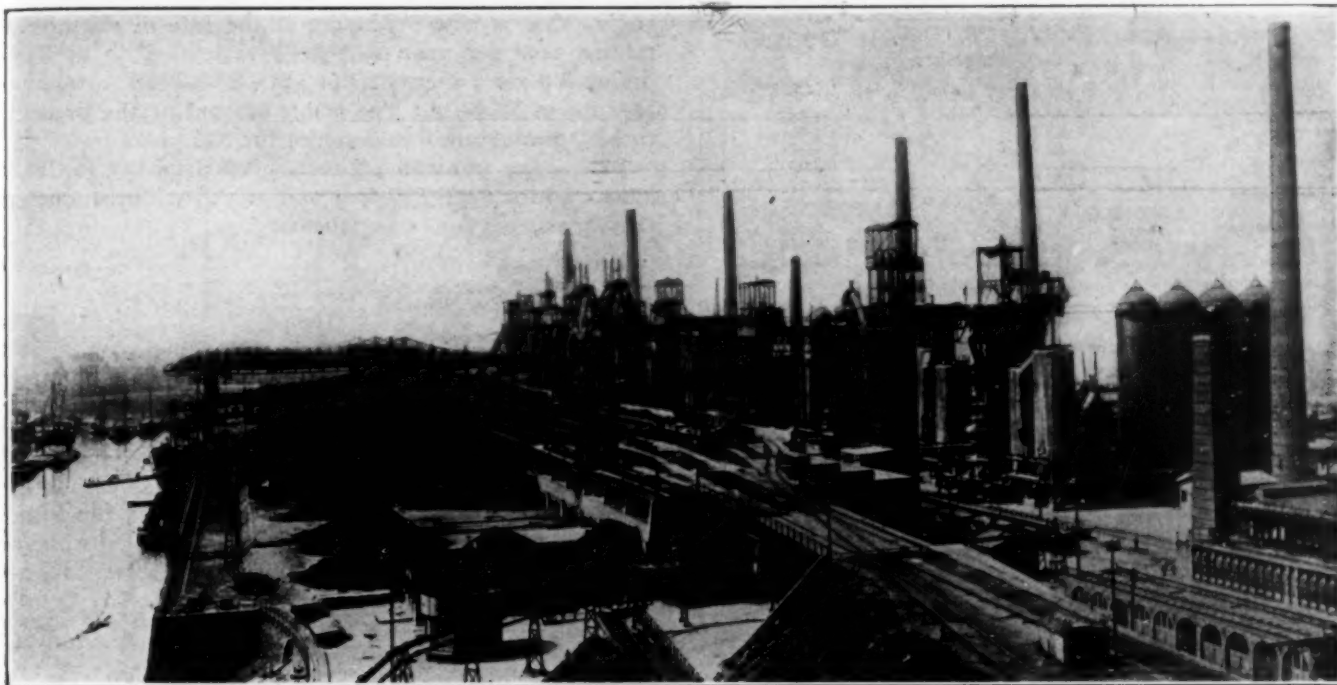


Photo by Underwood & Underwood

VIEW OF THE COAL DOCKS AT THE GREAT KRUPP WORKS AT ESSEN IN THE RUHR DISTRICT OF GERMANY

What Is in the Ruhr?

An Attempt to Answer This Question From a Chemical and Industrial Viewpoint, Pointing Out the Economic Significance of French and Belgian Occupation and Possible Effects on the World's Chemical and Metallurgical Industries

WERE the Pittsburgh district to be isolated completely from the remainder of the United States and to be occupied by 50,000 troops and a large technical commission of foreign nationals intent upon controlling production and distribution of that district's basic industries, some idea might be gained of the present situation in the Ruhr district and of its possible economic consequences to Germany and the rest of the world. The Ruhr district is Germany's most important asset—the greatest industrial center of that country, if not of all Europe. From a commercial and economic viewpoint it is to Germany what the Pittsburgh district is to the United States, what the Sheffield region is to England and what the French departments of Nord and Pas-de-Calais were to France before their destruction during the war.

The Ruhr district is not a geographical division of Germany, but geologically it is a well-defined strip of land of about 400 square miles bordering on the Ruhr River. As may be seen from the map on page 341, it stretches across the northern part of the Prussian provinces of Westphalia and Rhineland.

The industrial development of this district may be said to have started about 1850, when coal began to be mined there on an extensive scale. In 1913 something over 114,000,000 tons of coal was mined in the Ruhr district, representing fully 60 per cent of the total German production. As is the case in the Pittsburgh district, the Ruhr does not contain any workable de-

posits of iron ore, but rather the abundance of coal has been the factor that has made it the principal seat of Germany's iron and steel industries. The industrial centers of Essen, Bochum, Mülheim, Dortmund, Gelsenkirchen, Duisburg, Oberhausen, Ruhrort, Hörde, Witten—to mention only the most important—are the strongholds of Germany's industrial magnates.¹ There Stinnes, the Thyssens, the Krupps, the Haniels, the Kloeckners, the Funkes, play economic roles analogous to those of the Carnegie, Rockefeller, Harriman, Vanderbilt and Gould interests in this country.

INCREASING INDUSTRIAL POPULATION

A very illuminating survey of the economic importance of the Ruhr district was made not long ago by M. Dariac, a special commissioner of the French Government sent into the Rhineland in advance of the French and Belgian troops. He points out that in 1913 the industries of the territory now occupied employed one-fourth of all the factory workers in Germany. This includes 55 per cent of all workers engaged in mining, 27 per cent of those in metallurgy, 20 per cent of the chemical workers and 19 per cent of those in the textile industries.

¹According to a press despatch on Feb. 13 there were 46,942 French troops (officers and men) in the Ruhr and 12,000 French and Belgian railway men and engineers were at the disposal of the Technical Commission. The position of the troops of occupation was given as follows: Belgian detachment at Sterkrade; 47th French Infantry Division at Recklinghausen; 11th Infantry Division north of Dortmund; 40th Infantry Division south of Bochum; 128th Infantry Division at Essen and south of Essen.

TABLE I—POPULATION OF INDUSTRIAL CENTERS
IN RUHR DISTRICT

City	Population	
	1910	1919
Essen	194,653	439,297
Bochum	136,931	144,993
Dortmund	214,226	297,018
Oberhausen	89,900	98,677
Duisburg	218,400	241,788
Gelsenkirchen	169,513	179,785
Herne	57,459	64,135
Recklinghausen	59,283	60,498
Witten	37,450	37,189
Mulheim	112,580	127,353

The Krupp works alone, in 1913 employed 80,000 workers. During the war this number rose to 171,000, but by the end of 1922 had been reduced to about 100,000 employees.

While the total population of Prussia declined from 40,165,219 in 1913 to 36,771,951 in 1919, that of the Ruhr district showed a marked increase, due, probably, to the influx from the territories originally occupied by the Allied troops. The figures in Table I show the extent of this gain in some of the most important industrial centers in the Ruhr district.

AN INDEX OF INDUSTRIAL ACTIVITY

An idea of the productive and distributive capacities of the Ruhr district may be gained from statistics of inland traffic, both by water and land. In point of mileage the railroads in the territory now occupied by the French and Belgian troops are but 12 per cent of the total in Germany, but they actually handle practically three-fourths of the traffic of the entire country. In addition, 60 per cent of Germany's water transportation is in the Rhine and Ruhr districts.

Industrial Resources

Coal.—It was previously stated that in past years the Ruhr district has accounted for over 60 per cent of the coal production of Germany. The output of the most important districts in Germany during 1913 and 1919 were as follows (in millions of tons):

	Ruhr District	Upper Silesia	The Saar District	Total for Germany
1913	114.49	43.43	12.22	190.11
1919	71.16	25.93	8.97	116.50

or in percentage of the total:

1913	60.22	22.85	6.43	100.00
1919	61.08	22.26	7.70	100.00

Since the the loss of the Saar basin to France, Germany's coal production has been concentrated in the Ruhr district, so that the present Ruhr output is probably in the neighborhood of 80 per cent of the total. Production during 1921 and 1922, although somewhat lower than the 1913 production, nevertheless considerably exceeds the 1919 figure.

Table III, recently printed in *Coal Age*, shows the total production of the last 2 years as compared with that of 1913.

The coal resources of the Ruhr district from the

TABLE III—COAL PRODUCTION IN RUHR DISTRICT BY MONTHS

	1913	1921	1922
January	9,786,005	8,072,912	8,132,763
February	9,194,112	8,174,606	7,737,974
March	9,181,430	7,685,185	9,014,278
April	9,969,560	7,894,985	7,512,646
May	9,261,448	6,954,607	8,081,951
June	9,586,385	7,753,350	7,078,361
July	10,150,347	7,782,676	7,864,200
August	9,795,236	8,068,065	8,336,773
September	9,696,397	7,853,871	8,265,688
October	9,895,090	8,047,353	8,837,126
November	8,932,276	7,772,658	8,596,214
December	9,101,858	8,054,517	7,900,000
Whole year	114,550,153	94,114,785	97,350,000

region that is now producing at the rate of about 100 million tons per year have been estimated² to be 31.9 billion tons to a depth of 1,500 m. or 37.5 billion tons to a depth of 2,000 m. The latter amount at the present rate of production would suffice for 375 years.

Iron.—The pig-iron production of Germany in 1913 amounted to 19,291,920 tons and was distributed among the various provinces as follows:

District	Percentage
Rhineland-Westphalia	42.5
Siegerland, Lahn, Hesse-Nassau	5.1
Silesia	5.2
Central and eastern Germany	5.2
Bavaria, Wurttemberg and Thuringia	1.2
Saar	7.3
Lorraine and Luxemburg	33.3

Coal-Tar Products.—Before the war the byproduct coke ovens in Germany consumed annually about 45 million tons of coal. Of this amount it was estimated by M. Dariac that 25 million tons came from the Ruhr district. This would account for an output of ammonium sulphate and coal tar in approximately the following proportions:

	Total Production (Tons)	Ruhr District (Tons)
Ammonium sulphate	500,000	400,000
Coal tar	1,200,000	1,000,000

Of this production the Hugo Stinnes group industries accounted for 129,000 tons of coal tar and 69,000 tons of ammonium sulphate.

SITUATION IN THE DYE PLANTS

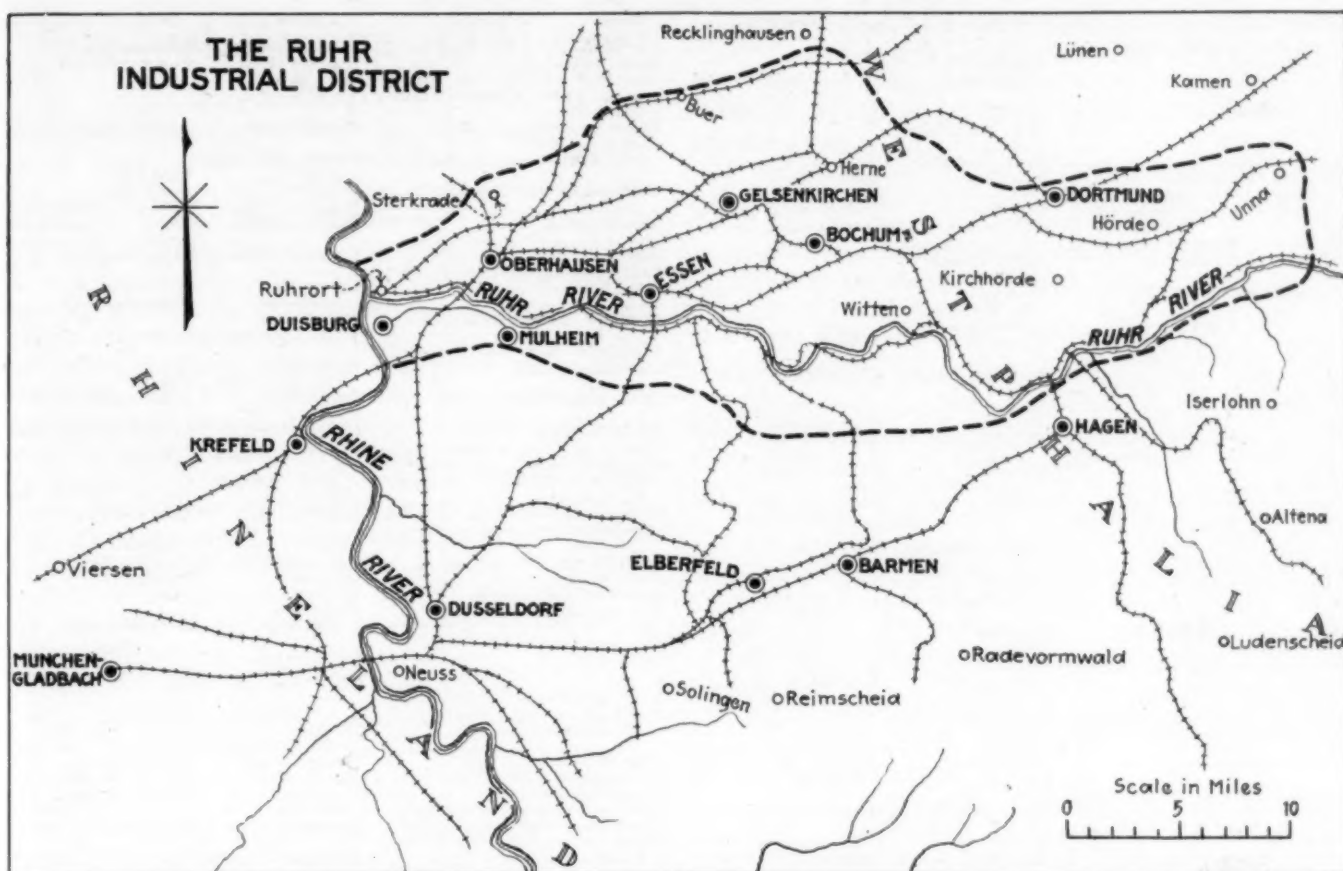
Chemicals.—Practically all of this coal tar passes into consumption in the form of the products of the German organic chemical industries—dyes, pharmaceuticals, color lakes, perfumes, photographic chemicals, etc. However, these industries for the most part lie outside of the Ruhr district as such, although at least 90 per cent of them are included within the territory which has been or is now occupied by the Allies. The great plants of the I.G. (Interessen Gemeinschaft) lie to the south of the Ruhr—Badische at Ludwigshafen-on-the-Rhine, Bayer at Leverkusen, Meister Lucius & Erüning at Höchst-on-the-Main, Cassella at Frankfurt and Kalle at Biebrich-on-the-Rhine. Of the less important companies Griesheim-Election is at Offenbach-on-the-Main, Weiler-ter-Meer is at Uerdingen-on-the-Rhine and Leonhardt is at Muhlheim-on-the-Main.

The only important coal-tar dye plant in the immediate vicinity of the Ruhr district is that of Carl Jager, G.m.b.H., Anilinfarbenfabrik at Düsseldorf. This company was founded in 1823 and while small as compared with the ground organizations of the I.G., it is nevertheless a recognized factor in the German industry.

These plants, whether actually within the occupied territory or not, are nevertheless dependent largely on the Ruhr district for their chief raw materials—for coal tar and the so-called crudes from its distillation such as benzol, toluol, naphthalene, anthracene, carbolic and cresylic acids, etc. Naturally the course of their future production will depend on their supplies of these basic materials and for that reason they are vitally affected by the embargoes on coal and coal products which the French are enforcing with increasing severity.

It is scarcely to be believed that the French would voluntarily cut off supplies of these byproducts for any extended period. Little market exists for them elsewhere and from a revenue viewpoint it would be much

²"The Coal Resources of the World," vol. III, p. 887 (1913).



MAP OF RHINELAND AND WESTPHALIA, SHOWING THE RUHR DISTRICT AND PRINCIPAL INDUSTRIAL CENTERS

more desirable that they be fabricated into finished products of much greater taxable value. However, the decreasing coking operations due to labor troubles in the coal mines, on the railroads and at the ovens would automatically cut down the supply of raw materials for the dye factories. It is therefore entirely possible that these great industries will eventually come to a standstill unless supplies in the way of coal and coal products can be imported into Germany from England or America.

It has been reported on the authority of high German officials in this country that many of the large dye and chemical factories of Germany now have on hand stocks of crudes and intermediates sufficient to carry them over a period of 4 to 6 months. Just how much credence can be placed in such statements is, of course, largely a matter of conjecture.

Chemical Plants in the Occupied Territory

Names and Addresses of Important Factories in Rhine and Westphalia and Adjacent Districts, Compiled by Department of Commerce

IN VIEW of the timely interest in the economic and industrial problems arising from the French occupation of the Ruhr Valley in Germany, the Commercial Intelligence Division of the Bureau of Foreign and Domestic Commerce has compiled a comprehensive list of chemical and allied factories within the occupied territory of Germany. This compilation is not as yet entirely complete, but it is believed that its publication,

even in fragmentary form, will be worth while at this time. The list follows:

Name	Address	Manufactures
Aachener Chemische Fabrik für Textilindustrie, G.m.b.H.	Aachen.....	Textile chemicals
Aktiengesellschaft für Bergbau, Blei und Zinkfabrikation zu Stolberg und in Westfalen.....	Aachen.....	Pig lead, raw zinc, sheet zinc
F. D. Beizel.....	Aachen.....	Varnish and putty
Chemische Fabrik Rhenania, A.G.	Aachen.....	Sulphuric acid, muriatic acid, nitric acid, sulphur, barium sulphate and many other chemicals
Chemische Präparate G.m.b.H.	Aachen.....	Pharmaceutical preparations
Chemische und Textilseifen-Fabriken, Charles Schein.	Aachen.....	Textile chemicals
Dr. Deckers & Co., G.m.b.H.	Aachen.....	Chemicals and oils
Xav. Goblet.....	Aachen.....	Scap, fullers soap
S. Grauer & Co., G.m.b.H.	Aachen.....	Polishing preparations
Kampe & Janson.....	Aachen.....	Oils and lime
Albert Heinrich Kendall.....	Aachen.....	Scap and perfume
H. Klocke.....	Aachen.....	Preparations for the textile industry
Dr. Georg Koenig.....	Aachen.....	Pharmaceuticals
Cl. Lageman.....	Aachen.....	Pharmaceuticals
Frans Lauffs.....	Aachen.....	Wax candles
Joh. Jos. Lauffs.....	Aachen.....	Wax candles
Medistal-Werk G.m.b.H.	Aachen.....	Pharmaceuticals
Peter Ney.....	Aachen.....	Scap
Jos. Preim.....	Aachen.....	Perfumery and scap
Reinland & Berns, Chemische Fabrik Optima.....	Aachen.....	Chemicals
S. Saul.....	Aachen.....	Rubber ware
Schleipen & Cie.....	Aachen.....	Chemical products
Dr. Schlenker & Baum.	Aachen.....	
Schreiber & Brandt.....	Aachen.....	Varnish
A. Steenaerts Nachf.	Aachen.....	Scap
H. Trommsdorff, chemische fabrik	Aachen.....	Pharmaceuticals
Gebr. Vossen G.m.b.H.	Aachen.....	Dyes
L. Vossen G.m.b.H.	Aachen.....	Chemicals
Gebr. Waeler G.m.b.H.	Aachen.....	Chemicals
Georg Heinrich Goebel.....	Ahrweiler, (Rheinpr.).....	Varnish and wood stain
Wilhelm Wira Nachf. H. Ksefor.....	Ahrweiler, (Rheinpr.).....	Varnish
Zuendholzfabrik, Albersweiler.....	Albersweiler (Pfalz).....	Match
Benedick Haupt & Cie.,		
Eugen Wischner.....	Altenessen (Rheinpr.).....	Chemicals
M. Dietrich.....	Alzey (Hessen).....	Scap
Louis Frits.....	Alzey (Hessen).....	Soap
Carl M. Diener.....	Amberg (Oberpfalz).....	Wax ware
Boegel & Michel.....	Annweiler (Pfalz).....	

Name	Address	Manufactures	Name	Address	Manufactures
Arienheller Sprudel und Kohlen Saure A.G.	Arienheller bei Rheinbroh.	Carbonic acid, mineral water	Chr. Rath.	Boppard (Rhpr.)	Soap, glycerine
Duerkheimer Bade- und Salinenverein.	Bad. Duerkheim (Pfalz)	Mother lye, bath salts	Herm. Renckhoff.	Boppard (Rhpr.)	Pharmaceuticals
D. Rathgeber.	Bad. Duerkheim.	Soap	"Reinland" Fabrik für Asphalt pappe, Teer und chem. Produkte G.m.b.H.	Breyll (Rhpr.)	Asphalt, tar paper
Rudolf E. Linkenbach.	Bad. Ems.	Soap	Wilhelm Genenger, Nachf.	Bruehl (Bs. Köln a/R.)	Soda, rosin
Dr. Trost Nachf. Inh. August & Otto Roth, Chemische Fabrik.	Bad. Ems.	Disinfectants and insect powder	Chemische Fabrik Bruehl Gottfried Kemtenich & Co., m.b.H.	Burgbrohl (Rhpr.)	Natural carbonic acid
Rheinische Kracuter-Verwertung G.m.b.H. in liquidation.	Bad. Neuenahr (Rhpr.)		Kohlensaurewerk Burgbrohl G.m.b.H.	Burgbrohl (Rhpr.)	White lead, carbonic acid
Chemische Fabrik Luetgen.	Baerendorf b/ Bochum, Westfalia		Gebr. Rhodius.	Burgbrohl (Rhpr.)	Chemicals
B. Amann.	Barmen.	Dyes	Gustav Rhodius.	Burgwaldnie a. Niederrhein.	Pharmaceuticals
Atlas-Werke Engels & Stracke, G.m.b.H.	Barmen.	Chemicals	Fabrik pharmaceutischer Praeparate, A. Stein.	Burscheid (Bs. Dusseldorf)	Candles
Bayrisch-Rhein Farbenfabriken Knechtel & Co.	Barmen.	Dyes	Bergische Kerzenfabrik G.m.b.H.	Burscheid (Bs. Dusseldorf)	Candles
Brune & Hoefnagel.	Barmen.	Photographers' suppl's	Rheinische Kerzenfabrik August Pfeiffer.	Cleve (Rhpr.)	Linseed and rapeseed oil
Chemische Fabrik Elengraben.	Barmen.	Acid	Clever Oelmuehle, G.m.b.H.	Cleve (Rhpr.)	Linseed and rapeseed oil
Carl Dicke & Co., Chemische Fabrik.	Barmen.	Ferrous sulphate	Clivia-Oelwerke, G.m.b.H.		
W. Kopp.	Bendorf a/Rhein.	Inks	Chemische Fabrik, Coblenz-Wallersheim, G. Wilkens Nachfolger, Dr. Kretzer.	Coblens a/R.	Fluorine, cobalt, etc.
Friedr. Wilb, Remy & Cie.	Bendorf a/Rhein.	Varnish and lead colors	Chemische Fabrik Luetzel G.m.b.H.	Coblens a/R.	Chemicals
Rheinische Gerbetoff- und Farbstoff Extract Fabrik, Gebr. Mueller A.G.	Benrath (Rheinpr.)	Tannic acid	Chemische Werke Rombach G.m.b.H.	Coblens a/R.	Chemicals
Bensberg-Gladbacher Bergwerks- und Huetten A.G. Berzelius.	Bensberg (Rheinpr.)	Lead, zinc ore and sulphuric acid	Louis Fischer.	Coblens a/R.	Soap, candles
Bensberger Chemische Fabrik.	Bensberg (Rheinpr.)	Varnish, lacquer	Franz Goerger.	Coblens a/R.	Waxen goods
August Boeringer.	Bensberg (Rheinpr.)	Matches	Hermann Josef Kropfle.	Coblens a/R.	Soap
Zuenderfabrik Bensberg, G.m.b.H.	Bergisch-Gladbach.		Radium Gummiwerk G.m.b.H.	Dellbrueck (Bs. Köln)	Soft rubber goods
Ceromitgesellschaft m.b.H.	Bergisch-Gladbach (Rhpr.)		Thomas-schlacken-Mahlwerk, G.m.b.H.	Dillingen a.d. Saar, (Rhpr.)	Fertilizer
Sprengkapsel-Fabrik Olpe G.m.b.H.	Biel (Rhpr.)	Asphalt and roofing supplies	Rheinische Fabrik fuer Elektrische Bogenlichtkohle "Excelsior," W. Gruedlbach.	Dinalaken (Niederrhein)	
A. W. Andernach.	Beuel (Rhpr.)	Pharmaceutical prep.	Gebr. Mueller.	Dorsten (Eestf.)	Soap powder
Chemische Werk "Concordia" G.m.b.H.	Biel (Rhpr.)	Colors, varnish	J. E. Ausbuetel.	Dortmund.	Surgical dressings
Dr. Lambotte & Schattenverg G.m.b.H.	Biel (Rhpr.)	All drugs, acids, etc.	Franz Brunck.	Dortmund.	Tar and ammonia
Dr. L. O. Marquart.	Biel (Rhpr.)	Vaseline	Chemische Fabrik, Theo. Fincke.	Dortmund.	Rosin, technical oils
Vaseline-Fabrik Rheinl., E. Waser-fuhr.	Biebrich a/R. (Hess.-Nass.)	Varnish	Chemische Industrie Funk & Cie.	Dortmund.	Oils
Brandscheid & Weyrach.	Biebrich a/R. (Hess.-Nass.)	Organic chemical prod.	Dorner Oelwerke, Creamer & Dahlmann.	Dortmund.	Fertilizer
Chemische Fabriken Dr. Kurt Albert.	Biebrich a/R. (Hess.-Nass.)	Artificial fertilisers	Dortmunder Thomasschlacken Mahlwerk, G.m.b.H.	Dortmund.	Tar and roofing prod.
Chemische werke vorm. H. & E. Albert.	Biebrich a/R. (Hess.-Nass.)	Coal tar dyes, pharmaceutical preparations	Th. Fahnenstich Soehne.	Dortmund.	Soap
Adam Hofmann.	Biebrich a/R. (Hess.-Nass.)	Vaseline, oils, etc.	Heinr. Fley.	Dortmund.	Ammonia, benzol, tar
Kalle & Co., A. G.	Biebrich a/R. (Hess.-Nass.)	Soap	Dorstfeld Gewerkschaft.	Dortmund.	Oil colors, varnish, putty
Dr. Th. Steinkauler, Victoria, Vaseline-Fabrik.	Biebrich a/R. (Hess.-Nass.)	Perfumes and soap	Hermann Hauelsen.	Dortmund.	Asphalt
Teerprodukten Biebrich, Seck & Dr. Alt, Jean Scholl.	Bingen a/R.	Technical oils, fat	Wilh. Klaas Soehne.	Dortmund.	Chemicals
Gebrueder Bier.	Birkenfeld (Fuerstentum)	Tar distillery, sulphuric acid, nitric acid	H. & E. Krukopf.	Dortmund.	Tar products
Chemische Fabrik, Walter Bosch, G.m.b.H.	Bochum (Westf.)	Benzol, tar, and ammonia	Rud. Kuepfer.	Dortmund.	Chemicals
Chemische-Industrie, Act.-Ges.	Bochum (Westf.)	Dyes	G. & W. Lambeck.	Dortmund.	Soap, candles
Deutsch Luxemburgische Berg werks und Huetten A.G.	Bochum (Westf.)	Varnish, lacquer and tar	Herm. Meier.	Dortmund.	Soap, glycerine
"Farbenmueller" Gesellschaft, G. m.b.H.	Bochum (Westf.)	Copper and pyrites	Herm. Meininghaus, jun.	Dortmund.	Dyes
Gruemer & Grimberg, G.m.b.H.	Bochum (Westf.)	Pharmaceuticals	Richard Meyer.	Dortmund.	Technical rubberware
C. Jungkenn, G.m.b.H.	Bochum (Westf.)	Asphalt, tar and rosin	Moritz Nake, Dortmunder Kohlen- ansaender-Fabrik in Dortmund, Wilh. Pahl, Dortmunder Gummi- waren Fabrik.	Dortmund.	Asphalt, tar products
Kupferhuetten Bochum, G.m.b.H.	Bochum (Westf.)	Oils	C. B. Ranke, G.m.b.H.	Dortmund.	Electric lights
Alf. Lewin.	Bochum (Westf.)	Explosives, matches, etc.	Fr. Sobbe, G.m.b.H.	Dortmund.	Colors, varnish
Joh. Chr. Leye G.m.b.H.	Bochum (Westf.)	Technical fats	Ueter & Grensdorfer G.m.b.H.	Dortmund.	Asbestos products
Theo. Schueking.	Bochum (Westf.)	Varnish	Vereinigte Asbestwerk Danco, Wetzol & Cie., Gesellschaft m.b.H.	Dortmund.	Explosives
Westfaelische Zuendwaren Indus- trie, G.m.b.H.	Bochum (Westf.)	Bandages, rubber plaster	Westdeutsche Sprengstoff Werk, A.G.	Dortmund.	Essences
Zeche Ver. Carolinenglueck.	Bonn a/R.	Special soap, varnish	Westfaelische Esensen-Fabrik, G.m.b.H.	Dortmund.	Resinous products, technical oils, and fats
Bach & Brucken.	Bonn a/R.	Varnish	Westfaelische Mineralöl, W. H. Schmits.	Dortmund.	White lead
Carl Blank.	Bonn a/R.	Varnish and colors	J. Beckers & Cie.	Dueren (Rhld.)	White lead
Bonner Chemischer Industrie, G.m.b.H.	Bonn a/R.	Artificial mineral water	Brüning & Soehne.	Dueren (Rhld.)	Asphalt, tar
Gebr. Bornfeld.	Bonn a/R.	Ink powder	Gebr. Caesar.	Dueren (Rhld.)	Chemicals
de Foy & Finking.	Bonn a/R.	Hygienic rubber goods	Chemische Fabrik Durania.	Dueren (Rhld.)	Chemicals
Joh. Hanstein.	Bonn a/R.	Pharmaceuticals	Chemische Fabrik K&S.	Dueren (Rhld.)	Pharmaceuticals
Hoffman & Dewald.	Bonn a/R.	Pharmaceuticals	Dr. Degan & Kuth.	Dueren (Rhld.)	Chemicals
Kleine & Flume.	Bonn a/R.	Pharmaceuticals	Rudolph Horst.	Dueren (Rhld.)	Photo. films
J. W. Plankucken Sohn.	Bonn a/R.	Wax candles, tapers	Kino-Film Co., m.b.H.	Dueren (Rhld.)	Explosives
Pharmaceutische Fabrik Stein.	Bonn a/R.	Waxen goods	Schicawollfabrik Dueren.	Dueren (Rhld.)	Pharmaceuticals
Dr. Pitschke's Chem. Laboratorium	Bonn a/R.		Vialonga Werke Apotheker Frits Schnell.	Dusseldorf.	Starch
Dr. Schuetz & Co.	Bonn a/R.		Actiengesellschaft der Remyachen Werke.	Dusseldorf.	Asphalt and tar
Schmithausen & Co.	Bonn a/R.		Bauartikel Fabrik A. Siebel.	Dusseldorf.	Chemicals
Adam Segschneider.	Bonn a/R.		Gebr. Bauer, Chemische Fabrik.	Dusseldorf.	Chemicals
Wilhelm Vollmar.	Bonn a/R.		M. D. Baumann, Chemische Fabrik.	Dusseldorf.	Chemicals
Thomasschlacken-Mahlwerke	Borbeck (Kr. Essen)	Fertilizer	Bergisches Kraftfutterwerke G.m.b.H.	Dusseldorf.	Chemicals
Oberhausen, Gesellschaft m.b.H.	Boppard (Rhpr.)	Technical oils and fats	Sali Blum, Chemische Fabrik.	Dusseldorf.	Chemical products
Fabrik-Chemische-Technischer	Boppard (Rhpr.)	Pharmaceuticals	Ferdinand Braukmann & Co. G.m.b.H.	Dusseldorf.	Perfumery
Produkte, Philip Frank.			Carl Ed. Braun, G.m.b.H.	Dusseldorf.	Percussion caps
Pharmaceutische Fabrik Asta, G.m.b.H.			Braun & Bloem, G.m.b.H.	Dusseldorf.	Rubber and gutta-percha goods
			H. Breithaupt.	Dusseldorf.	Varnish
			Heinrich Brinken.	Dusseldorf.	Chemicals
			Eugen Bruchhaus.	Dusseldorf.	Varnish
			Ernst Richard Buechner.	Dusseldorf.	Dyes and varnish
			Rudolf Buenger, G.m.b.H.	Dusseldorf.	Chemicals
			Buechter & Co.	Dusseldorf.	Colors
			P. H. Buschbell.	Dusseldorf.	Oils and fats
			C. A. Calmar Sohn.	Dusseldorf.	Chemicals
			Chemische Fabrik fuer Huetten- produkte, A.G.		

Regional Meeting at Chicago A.S.S.T.

Measurement of Cooling Rate; Its Effect on Structure of High-Carbon Steel; Microphotography and Metallurgical Education Hold Attention of Members

PURSUANT to their admirable plan, the various local organizations near by Chicago united in a regional meeting on Feb. 8. Two technical sessions were held during the afternoon and evening, while the social animal was appeased by luncheon and supper served at the City Club. On the following day many members and their guests made inspection visits to nearby steel works or forge plants. In this way many men who have not the means or the opportunity to attend one of the national conventions held by the American Society for Steel Treating in some distant city can participate in all the convention activities near at home at least once a year.

Brief notes on the formal papers read at the session appear below.

HOT BODIES COOLING IN AIR

E. J. Janitzky, metallurgist of the Illinois Steel Co., noticed that cooling curves assume a shape approximately that of a rectangular hyperbola, and upon investigation found this indeed to be a fact. When plotting time against temperature at the center of a $\frac{1}{4}$ -in. cylinder of high-nickel steel $2\frac{1}{2}$ in. long, cooling in air, he found that the correspondence was extremely good, and since then he has checked the same relation for very large masses, such as ingots or annealing furnaces, and has verified the assumption by figures already published by various investigators.

The entire matter can be generalized if a rectangular hyperbola be plotted, having the x axis as one asymptote, and the ordinate $y = -1$ as the other. The equation for this curve is

$$y = \frac{K}{x + 1}$$

K is the intersection with the y axis and represents the temperature of the body at the beginning of the cooling; y is the temperature of the body at any time thereafter. The unit of x is the "time constant," or the time required (in minutes, seconds or hours) to cool the body half way to zero.

As an instance, for the small nickel steel specimen cooling in air at 80 deg. F., it required 4.7 minutes to cool from 1,750 to 875 deg. F. Call this time the first period. During the second period (or at the end of 9.4 minutes) it will cool to

$$y = \frac{1750}{2 + 1} = \frac{1750}{3} = 585 \text{ deg. F.}$$

At the end of the third period it will cool to $\frac{1}{3}$ of 1750 or 437, of the fourth period it will be at $\frac{1}{4}$ of 1750 or 350 deg. F. and so on.

Computed and actual results follow:

	Pyrometer	Calculated	Time Interval	
			x	Minutes
Original temperature.....	1750		0	0
	875	875	1	4.7
	580	585	2	9.4
	445	437	3	14.1
	340	350	4	18.8
	285	290	5	23.5
	240	250	6	28.2

The matter of predicting the approximate time when the body will reach a given temperature resolves itself into a very simple arithmetical calculation, requiring only the experimental determination of the time re-

quired to cool one-half the distance to zero. This time (the "time constant") evidently varies with the material, its shape, mass and temperature to which heated; it cannot easily be predicted, but can very easily be measured.

If the cooling is delayed by transformations in the body—as for instance steel at the recalcence point—the cooling is merely interrupted the time necessary to complete the transformation—that is to say, the y axis is shifted to the right an equivalent amount.

TECHNIQUE OF MICROPHOTOGRAPHY

An interesting set of micros, taken at very high magnifications, were shown by R. G. Guthrie, of the People's Gas Light & Coke Co., while recounting some of the precautions necessary before such work can be successful. He also cited the methods of producing sensibly monochromatic light and the reasons for its utilization; ray filters recommended by the manufacturers of the particular plates used by the operator will usually be most satisfactory. While a single filter will cut out a large number of wave lengths, a combination of two or more will be found very useful to narrow down the transmitted beam. He regards the panchromatic plate as the ideal for many purposes, despite the fact that it must be handled with the greatest care, owing to its sensitivity to infra-red rays.

In experimenting with polarized light, he attempted to use it in an ordinary Leitz metallurgical microscope to photograph opaque specimens. He mounted the polarizer just ahead of the sub-stage condenser, and the analyzer in the tube carrying the ocular. Using sensibly monochromatic light, it was easy to photograph the structure in its usual aspect when the prisms were set parallel to each other. Crossed Nichols should have showed the field dark, which was found to be true only when the beam consisted of an extremely small pencil of rays. Opening the diaphragm somewhat allowed a photograph to be made of the structure in extremely curious contrast, suggesting a badly overexposed print on blueprint paper. While the speaker was unable to point to any present utility of the method, it seemed to be in effect an example of the possibility of photographing metallic specimens at high magnifications and under oblique illumination—polarized light being essentially that.

EDUCATION

Remarks on the ways and means of capitalizing upon metallurgical achievements were made by E. E. Thum, associate editor of *Chemical & Metallurgical Engineering*. Noting that while there is doubtless much pseudo-engineering masquerading as technical control, a successful metallurgical or testing department was bound to contribute toward a reduction in manufacturing costs. The problem then is properly to show these savings in a way that the auditor, the manager and his board of directors cannot help but see. When that has been done, their services will be valued in direct proportion to the amount of profit they can show—they will become something more than a salary expense.

After recounting the wide variety of activities and interests occupying their attention, the speaker recommended that the best way to sum all these things in the ledger was to have a departmental account started for the testing or metallurgical department. Then it would be possible to charge the various manufacturing departments for services rendered at a fair rate, and to secure the proper book credit for new developments and econ-

omies suggested in the operations. These will easily be found to overbalance the salaries and expenses of the necessary investigations.

STRUCTURE OF HARDENED HIGH-CARBON STEEL

A 1.78 carbon steel, quenched from 1,080 deg. C., was examined by Howard Scott of the Bureau of Standards. He found the interior to consist of good-sized polygonal grains, shot through with feathery needles (plates) and containing a little massive cementite at the grain junctions—evidently unabsorbed excess constituent. Some decarbonization occurred at the very surface, since there was no massive cementite observed in the microsection; the appearance there was a typical granular martensite of hardened tool steel. In a thin intermediate zone the polygonal grains characteristic of the center contained zigzag apparitions, like lightning flashes, and few if any needles.

The interior grains are thought to be austenite, because they have a simple polyhedral outline. It is plastic, because squeezing in a vise develops twins and slip bands. Cooling to liquid air buckles the surface and develops a structure suggestive of martensite. When cooled from 1,080 slowly—i.e., in a mild air-blast—it develops small areas of a dark-etching constituent like troostite, and the grains completely transform to this material on tempering at 350 deg. C.

Massive cementite, free at the grain boundaries and envelopes, is easily identified by its characteristic color and shape and by darkening after the sodium-picric etch. Feathery needles (plates in three dimensions) also etch dark in sodium picric; they usually grow from the grain envelopes, and spheroidize on tempering to 600 or 700 deg. C. Scott therefore dubs them cementite, soluble in austenite at 1,080, but precipitated along cleavage planes during cooling.

Zigzags are thought to be thick plates of martensite. They appear in the austenitic grains after cooling in liquid air. On tempering to 250 deg. C. they etch much quicker, and when the structure is tempered to 600 deg. C. and becomes sorbite, the needles persist as white

ghosts, and contain fewer cementite particles than their surroundings. Sometimes they occur in the same grain with a broad-banded twin, from which they can be easily distinguished by form and etching characteristics.

If these conclusions as to the identity of the structural constituents are correct, it follows that in a very high-carbon steel quenched from a very high temperature, an austenitic core is produced at a moderately slow cooling rate—slower in fact than that producing martensite in the lower-carbon steel at the edges. Furthermore, this austenite appears to transform directly into troostite (by slower cooling or mild tempering) without any intermediate martensitic stage appearing.

Such facts are generalized in a diagram of the "stepped" transformation (Fig. 1) as indicated by many recent researches on quenching. A eutectoid steel, cooled slowly, or at a rate less than that indicated at A, will transform abruptly at A_r (in the neighborhood of 650 deg. C.) from austenite into pearlite. At somewhat faster rates, the transformation appears to split; some austenite appears to change to troostite at A_r' (650 deg. C. \pm) and the rest into martensite at A_r'' (250 deg. C. \pm). The final structure of eutectoid steel is a mixture of troostite and martensite. If the steel contains much more carbon, as the 1.78 C steel under discussion, and is quenched from a high heat, A_r' and A_r'' are lowered, A_r'' occurring below atmospheric temperature and therefore suppressed. Then the steel will be austenitic with some troostite. Supercooling in liquid air passes A_r'' , and develops the structure expected in a eutectoid steel. For very rapid rates of cooling the steel is either austenitic or martensitic, depending upon whether A_r'' is above or below the lowest temperature attained during the quench.

Quenching experiments with lower-carbon steels—containing 1.16 and 1.04 per cent carbon respectively—were made to discover the rate at which the cooling must be effected in order to preserve the martensitic structure (B of Fig. 1). These developed a number of surprises, most notable of which is that it is easy to produce a specimen possessing a martensitic core and a muff partly or entirely of troostite. Evidently some other factor than rate of cooling is responsible for the ultimate structure. Consideration of the facts in this case led the author to discuss the effect of internal stress upon the transformations found in steel.

Mathematical analysis of the cooling at various regions in a steel ball was given to show how the rate of cooling, and therefore cooling stresses, varied at different times during the cooling. In this way it was possible to show that quenching from a high temperature at certain rates will throw high tensions in certain regions. Since the transformation austenite \rightarrow troostite involves an increase in volume, pressure will lower the temperature at which it occurs (A_r') or restrict the transformation, and conversely tension will increase it, and cause troostite to appear in considerable masses where only austenite would be expected from a consideration of cooling rates only.

Production of Talc in Canada

In a report just published by the Canadian Department of Mines, the production of talc in Canada in 1920 amounted to 21,000 tons. Virtually the whole of this quantity was derived from the Madoc area of Ontario.

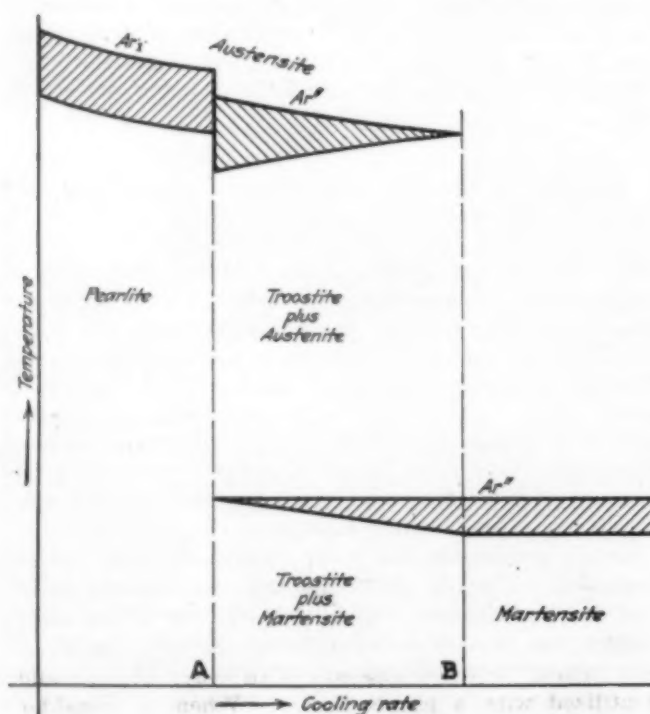


FIG. 1—TRANSFORMATION IN HIGH-CARBON STEELS

How to Save Money by Proper Methods of Barrel Handling

BY MATTHEW WILLIAM POTTS
Consulting Engineer, New York City

IN PREVIOUS article,¹ on "The Dollars and Cents of Careful Barrel Handling," we merely led up to the most important point—namely, the storage of barrels. The amount of care taken in storing, handling and filling of barrels has a great deal to do with the method of storage and the ultimate success or failure of the barrels as containers, providing it is necessary to store them for any length of time after they have been filled, and also has a great deal to do with how the barrel will stand up in storage after it is received at the consumer's plant.

There are certain fundamentals in barrel storage that apply in both the manufacturer's plant and the consumer's plant. Each branch of the industry has certain requirements that must be met. The pertinent questions which apply in most cases are:

1. How are the barrels received at the storage warehouse—i.e., conveyors, hand trucks, tractors and trailers, motor trucks, railway sidings, etc.?
2. How long will the barrels remain in storage?
3. What is the nature of their contents—i.e., liquid, powder, dangerous, neutral?
4. How many different products are to be stored?
5. Is there more than one grade of the same product—for instance, chemicals of different analysis?
6. How must the materials be taken out of stock—i.e., must the oldest stock be taken out first?
7. Is storage space plentiful or must every cubic foot be utilized?
8. Is it necessary to take a complete physical inventory? If so, how often?

There are numerous other questions which will present themselves such as, Is the warehouse space all on one floor, or on different floors which would necessitate the use of elevators? What is the allowable floor load? This last question will regulate the height of piling. It is difficult therefore to go into detail unless we could take into consideration some particular

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¹Chem. & Met., vol. 28, No. 7, Feb. 14, 1923.



FIG. 6—HOW NOT TO STORE BARRELS

Here is shown poor aisle space, absence of dunnage and thirty varieties of commodities. Question: How would you get at barrel "A"?

The Right and Wrong Methods of Storing Barrels Are Both Pictured and Described — A Number of Generalizations on the Care of Barrels Are Then Derived From the Examples

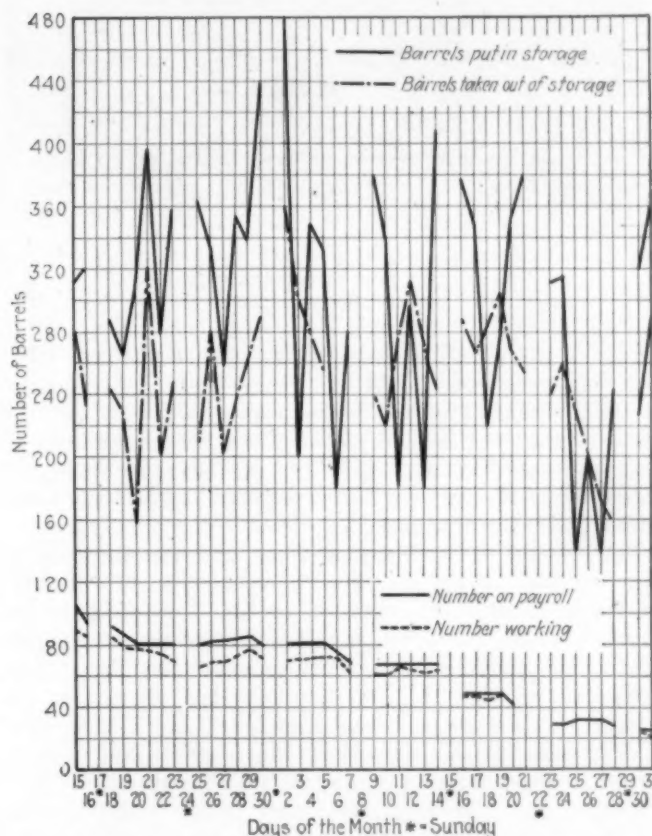


FIG. 7—DIAGRAM SHOWING THAT SAME NUMBER OF BARRELS COULD BE HANDLED BY A DIMINISHING FORCE WHEN PROPERLY ORGANIZED

warehouse and discuss the relative merits of each system in conjunction with that warehouse. We can, however, at this time show illustrations of proper and improper methods of barrel storage that have been and are now existing in some of the largest chemical plants throughout the country.

ONE WAREHOUSE WHICH SAVED \$20,000 PER YEAR ON BARREL HANDLING

In the warehouse one of the most important points to consider is the layout of aisles; next, the piling of the barrels; third, the proper method of building the piles. Looking at Fig. 6 we see a condition that exists in over 50 per cent of the chemical plants throughout the country. This is a poor and wasteful method of storing barrels. First, there is poor aisle space; this runs up the labor cost. Second, there is no dunnage between the tiers of barrels; this causes damage to the heads of the bottom barrels and also runs up the labor cost. Third, the group contains about thirty different products, and the one marked A might be required first. There is also waste overhead space which could be utilized with a proper layout. When we consider that this same condition existed throughout 40,000 sq. ft. of floor space, we can picture a real problem. Only



FIG. 8—TIERING TRUCK HANDLING AND PILING BARRELS OF LEAD OXIDE. AVERAGE WEIGHT OF BARREL 1,100 L.B.

imagine the overhead space that could be utilized if the layout was proper. Taking this condition and making a rearrangement of aisles and products, the writer was able to reduce the labor force from fifty-three men to thirteen men in a month and a half; increase the capacity of the warehouse 50 per cent; and at the same time handle more barrels.

The trend of the improvement and the number of barrels handled per day are shown in Fig. 7. By adding the number of barrels put in storage and the number taken out of storage the reader can easily find the total number of barrels handled per day. For instance, on the 31st, or the last day shown on the chart, there were thirteen men working. These men placed 360 barrels in storage and removed 290 barrels from storage, making a total of 650 barrels handled in a 9-hour day. These thirteen men include the foreman, checkers, coopers and painters, but do not include the office force.

The main point in reducing the force was the layout of aisles, but the use of electric tiering machines played an important part also, and the installation of a ramp conveyor to carry the barrels to the car-loading platform was another great assistance. The new arrange-

ment permitted the barrels to be tiered four high on the chimb.

This reduction in the force of labor required had several advantages. First, it reduced the payroll by \$24,960 per year. The new equipment cost \$5,000, so this meant a saving of \$19,960 in the first year over and above the cost of the equipment. Second, it eliminated considerable labor trouble and made supervision easier, as thirteen men are easier to handle and keep satisfied than fifty-three men.

THREE METHODS OF STORING BARRELS

Looking at the problem of barrel storage in general, whether the amount stored is a small or a large quantity, there are only three distinct methods of storage. The best method to be used depends upon whether the product being stored is in dry or liquid form, and not on the quantity to be handled. The three methods are here given in their order of preference:

1. In racks on the bilge. (See Figs. 10 and 14.)
2. On the bilge with dunnage. (See Fig. 9.)
3. On the chimb with dunnage. (See Fig. 12.)

The rack system of storing is without a doubt the best method, as it allows systematic storage by groups, products, analysis, etc. The separate tiers makes lotting of stock simple, convenient and inexpensive. Each tier of barrels is separate and accessible, being held free from those above and below. This allows considerable flexibility of storage space and prevents pressure on the lower tiers—pressure which with the other methods results in parting of the staves and leakage.

With the rack system it is possible to take a complete physical inventory at any time, as all barrels are easily reached by leaving a foot of space between racks. If it should become necessary to remove any particular barrel it may be done easily, whether the barrel is in the uppermost or in the lowest tier, and at a minimum expense. Another advantage is the ability to utilize all overhead space. With racks it is possible to tier barrels as high as ten tiers or to a height of over 20 ft.

If the barrels contain liquids, it is often necessary to turn them slightly so as to keep all sides moist and prevent loss of content, through staves that have dried out, when the barrel is removed from stock. With the rack system this turning can be frequently done with little expense and effort.



FIGS. 9 AND 10—PROPER AND IMPROPER WAYS OF STORING BARRELS CONTAINING LIQUIDS
Fig. 9—All barrels should be stored on the bilge. The method of dunnage shown is correct.

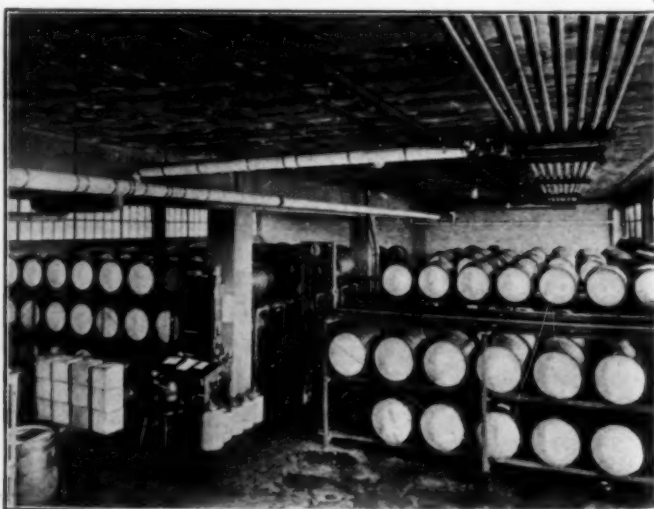


Fig. 10—Same warehouse as shown in Fig. 9 after it has been equipped with steel racks. Storage increased 50 per cent.

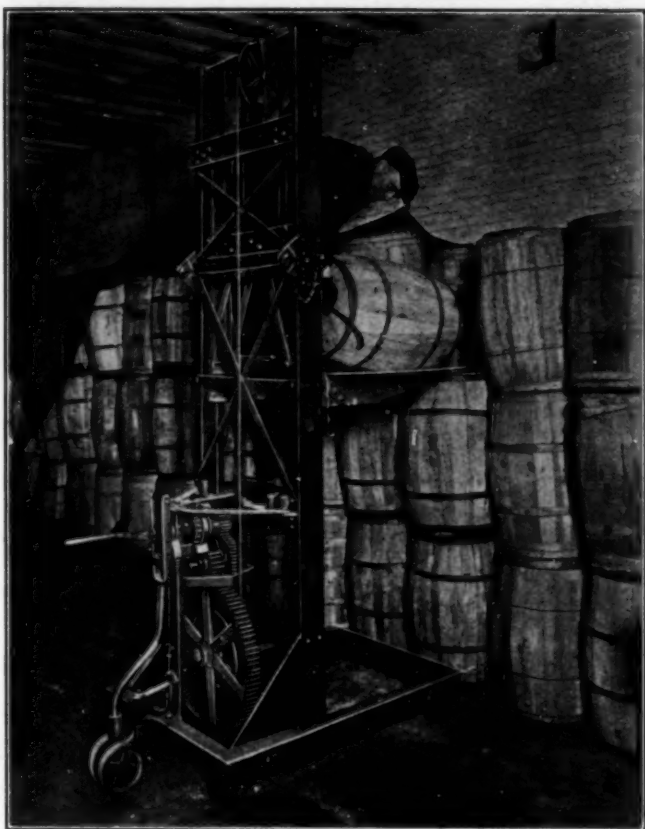


FIG. 11—IMPROPER METHOD OF PILING BARRELS
Note uneven piles, which results in accidents. See text regarding position of tiering machine.

The economical advantage of the rack system is the small labor force required to operate a warehouse where racks are installed. In most cases one man with a portable elevator (or tiering machine) can do all the work of placing and removing the barrels from stock.

It is true that barrels can be stored without being placed in racks, but they will not be as accessible and there is more chance of damaging the barrels. Looking at Fig. 8 we see a good method of handling, tiering and storing barrels except that the bottom tier should be on the bilge and resting on dunnage placed on the floor. We can agree, however, that it would be impossible to remove the bottom barrels without taking down the whole pile. This means that this system is useful and practical only where the products are all the same grade. It would be impossible to pile the barrels in this manner if they contained liquids, as the excessive pressure would spread the staves and cause leakage. In this warehouse, if liquids were being stored instead of dry products, it would be impossible to pile the barrels more than two high, and the remaining 8 ft. of headroom would be wasted.

Fig. 9 shows the proper way to store barrels containing liquids, providing dunnage is being used in place of racks. Note the dunnage on the floor, which gives two points of contact on the staves of the barrels instead of placing all the pressure directly on the bilge. The two points of contact also hold the barrels steady and prevent accidents from a wabby pile. The dunnage for the second tier is also shown. It is not recommended to pile liquids over two high with this system, but barrels containing dry products can safely be piled as high as four tiers.

Fig. 10 shows the same warehouse equipped with racks. Note the additional increase of 50 per cent by

adding the third tier of barrels. If this warehouse had been built with the idea of using racks, a slight rearrangement of the overhead steam pipes would have permitted the placing of a fourth tier, which would have allowed an increase of 100 per cent over the old method. This photograph shows very clearly the narrow aisles that are possible with the use of racks and also how the bottom barrels can be removed without disturbing the upper tiers.

PRACTICE IN HANDLING SLACK COOPERAGE

The illustrations so far have shown only tight cooperage. Figs. 11 and 12 show two ways of storage, a proper and an improper method. While these photographs show slack cooperage, it is only incidental.

Looking at Fig. 11 we see a good example of how not to pile barrels and also the wrong way to use a portable elevator (or tiering machine). First, there is no dunnage between tiers of barrels; this makes a very unsteady pile which is dangerous and does not permit of the full use of the overhead space. If dunnage had been placed in this pile, it would have been possible to pile the barrels four high, thus increasing the storage capacity by 33½ per cent. It is plain to see that some of the barrels are resting directly on the heads of those beneath; this often causes breakage of the heads. The portable elevator should be placed with the pile or at right angles to the position shown in order to operate efficiently. Placed in its proper position the machine will work in narrower aisles and the barrels can be rolled on from the front of the machine and off at either side without moving the machine. This important point is often overlooked.

Fig. 12 shows the proper way to pile barrels and



FIG. 12—PROPER AND EFFICIENT METHOD OF PILING BARRELS CONTAINING DRY PRODUCTS

also the proper position of the portable elevator in relation to the pile. Note the dunnage beneath the bottom barrels so as to allow the moisture from the floor to escape, thus eliminating the swelling of the bottom heads. Observe the straight even piles, the placement of the dunnage, the nearness of the portable elevator to the face of the pile and the number of men used in piling this material.

Fig. 13 shows the wrong way to place a portable elevator and also shows how the contents of the barrels leak out between the staves when they are stored on the chimb. Fig. 14 illustrates the use of the rack system and the proper placing of the portable elevator when it is used in conjunction with racks. Note how some of the barrels from the bottom tiers have been removed without disturbing the upper tiers.

There are a number of points which have not been touched in this article, and a number that are found only in certain branches of the chemical industry. It will be found advantageous by most companies to look over their present methods of barrel storage and to correct the faults set forth in this article. It will also pay to have their engineering department or an outside consulting engineer make a study of their barrel storage. Often little items that are being daily overlooked will amount to a loss of thousands of dollars per year that could be saved without a very large investment. Under this heading comes the matter of space. Are you getting the maximum amount of storage possible in a given space?

A FEW AXIOMS IN BARREL HANDLING

In conclusion a few general points about the handling and storage of barrels should be listed and followed to obtain the maximum results and possible economies.

1. Keep the barrels dry; never leave them outdoors even for an hour without covering.
2. Never store barrels in a draught, in a sunny room, in a wet cellar or where temperature is in excess of 60 deg.



FIG. 13—POOR LAYOUT OF WAREHOUSE AND AISLES
Note contents of barrels leaking between the staves.



Courtesy of the Economy Engineering Co.

FIG. 14—EXCELLENT LAYOUT OF BARREL RACKS
Proper method of storing barrels and proper location of tiering machine in placing barrels.

3. Maintain an even temperature in the warehouse.
4. Always store on the bilge with the bung stave up. This is the weakest stave in the barrel.
5. Never store on the chimb without placing dunnage between tiers.
6. Always cooper barrels by machinery. It gives a better and tighter job.
7. Never drop a barrel. To do so may break the staves.
8. Use a paper lining in barrels containing dry products.
9. Size (line) barrels that will contain liquids to prevent the wood absorbing the product.
10. Never fill barrels with products that are hot. The barrel will expand and develop leaky joints as soon as it cools.

Coke Byproducts of 1922

The U. S. Geological Survey has issued preliminary statistics indicating a production of 28,493,000 tons of byproduct coke and 8,033,000 tons of beehive coke during 1922. On the assumption that the yield of byproducts from coke ovens in 1922 bore the same relation to the coke production as in 1921, the following recoveries of various products are estimated:

Tar, gal.	365,000,000
Ammonia (sulphate equivalent of all forms), lb....	946,000,000
Gas, M. cu.ft.	447,000,000
Crude light oil, gal.	111,000,000

The Survey has issued preliminary figures by states and by months as a part of a recent weekly coal report. Those desiring these data can secure them on application to the Survey, Washington, D. C.

The Chemical Engineer's Part in the Rescue Work at the Argonaut Mine Disaster

How the Composition of Escaping Gases Was Used to Follow Progress in Controlling the Fire
—Estimate of Extent of Destruction
Based on Gas Analyses*

By L. H. DUSCHAK

Chemical Engineer, San Francisco

WHEN the fire was discovered in the vicinity of the 3,000-ft. level of the Argonaut shaft in California shortly before midnight on Aug. 27, 1922, the mine was being ventilated in the usual manner by an exhaust fan situated near the collar of the Muldoon shaft, which with the communicating system of raises and connections formed the return airway. As no change was made in the system of ventilation after the fire started, a dense cloud of smoke was soon emitted by the fan. This continued for about 3 hours, after

Co. At this time the churning of the fan indicated that it was handling much less than the normal volume of air.

During Wednesday and Thursday the composition of the fan discharge remained practically unchanged, indicating that the efforts to extinguish the fire were unavailing. Exploration made Thursday afternoon by an apparatus crew under the direction of B. O. Pickard of the U. S. Bureau of Mines disclosed burning timbers below the 2,500-ft. level. These were extinguished without producing any material change in the gas discharged by the fan and it was evident that a vigorous fire was still burning considerably below this point. On Friday it was decided that further efforts to extinguish the fire by the application of water from above were useless and a tight bulkhead was constructed across the shaft below the 2,500-ft. level. Bulkheads in the drifts on the 2,400- and 2,500-ft. levels were also repaired and sealed with clay in order to prevent any fresh air from reaching the fire zone. The efficacy of these bulkheads was shown by an almost immediate decrease in the quantity of CO_2 and CO in the fan discharge.

On Sunday, Sept. 3, an exploring party crossed from

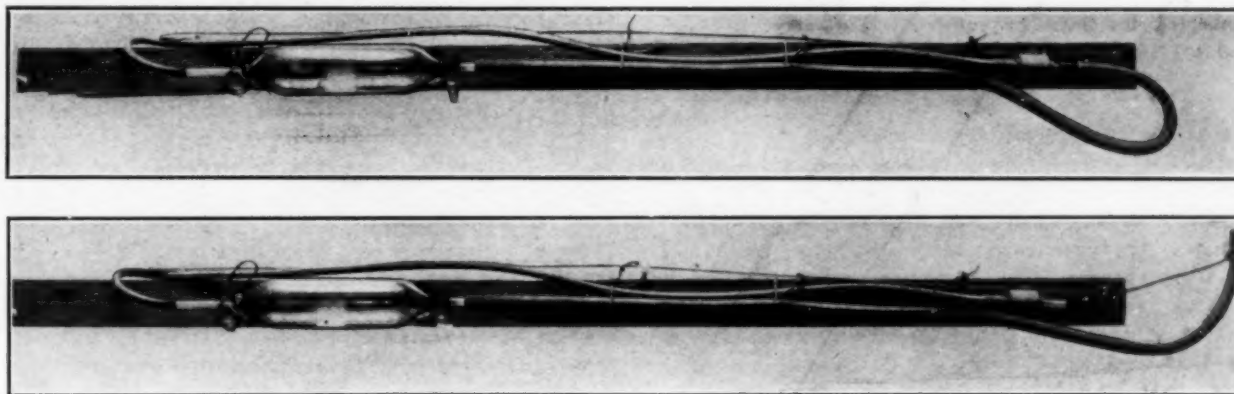


FIG. 1—GAS SAMPLING APPARATUS USED AT ARGONAUT MINE

which the density of the smoke cloud materially decreased, but the fan discharge was still of a highly toxic character. Owing to the limitations of the oxygen-breathing apparatus, any attempt to reach the working levels of the mine through the Muldoon system was out of the question as long as the Muldoon atmosphere remained irrespirable. An accurate knowledge of the condition of this atmosphere was therefore essential in planning the rescue program.

Regular gas sampling at the Muldoon fan was commenced on Wednesday morning, Aug. 30. A typical analysis was as follows: O_2 , 17.6 per cent; CO_2 , 2.8 per cent; CO , 0.7 per cent. Analyses were made with a standard Orsat apparatus, following the procedure outlined by Kreisinger and Ovitz.¹ Carbon monoxide determinations were also made with the carbon monoxide detector,² manufactured by the Mine Safety Appliances

Co. the Argonaut shaft to the Muldoon end of the 2,400-ft. level. The raise coming up to this point carried all of the gas escaping from the lower levels of the mine. A sample taken at that time with the apparatus shown in Fig. 1 and analyzed later in the usual way had the following compositions: O_2 , 13.0 per cent; CO_2 , 6.2 per cent; CO , 0.9 per cent. A comparison of this and subsequent samples at this point with samples taken at the fan showed that between the 2,400-ft. level and the surface, the gas coming from the lower levels of the mine was diluted with approximately twice its volume of fresh air entering through superficial workings.

Systematic sampling was continued both at the fan and the 2,400-ft. level and anemometer and temperature readings were taken regularly at the latter point. Owing to the greater significance of the observations made at the 2,400-ft. level a selection from these data, given in Table I, will be sufficient to show the course of events.

TABLE I—COMPOSITION OF GASES AT 2,400-FT. LEVEL

Date	Time	Temp., Deg. F.	Air Vol., Cu.Ft. Per Min.	Gas Composition (in Per Cent)			
				By Orsat		By Detector	
				CO_2	CO	CO_2	CO
9-3	8:00 p.m.	80	5,000	13.0	6.2	0.9	...
9-6	11:00 a.m.	80	5,000	12.8	7.0	0.9	...
9-8	4:00 p.m.	80	4,000	13.6	6.3	0.5	...
9-12	3:00 p.m.	80.6	3,800	15.2	5.0	0.6	0.5
9-14	11:00 a.m.	79.7	3,900	15.5	4.6	0.4	0.5
9-16	11:15 a.m.	80.0	4,100	15.2	3.9	0.2	0.1
9-17	3:30 p.m.	80.6	4,500	16.1	4.0	0.1	0.05

*The writer spent 4 weeks at Jackson, Calif., as consulting engineer for the Industrial Accident Commission of California. He desires to acknowledge the assistance rendered by Orr Woodburn, of the Globe Miami District Mine Rescue and First Aid Association, and of various rescue men working under the direction of B. O. Pickard, of the U. S. Bureau of Mines.

¹"Flue Gas Analysis by Means of the Orsat Apparatus," by Henry Kreisinger and F. K. Ovitz. Bulletin 97, U. S. Bureau of Mines.

²So far as the writer knows, this was the first time that the carbon monoxide detector has been used to any extent in connection with a mine fire. Its indications were checked repeatedly by the Orsat apparatus and also confirmed by tests with canary birds. It was found that the color scale of the instrument could be easily read underground in the concentrated beam of two carbide lights or two pocket flash lights. The simplicity of the instrument and the ease with which determinations are made suggest that it might be of use in connection with regular mining operations.

Accurate work with the anemometer was impossible and the variations in the gas volumes shown above are without significance. The gradual decrease in the CO₂ and CO showed that the fire was being slowly smothered owing to the continued effectiveness of the bulkheads. At times large quantities of water mist were present in the gas coming up the Muldoon raise at the 2,400-ft. level. The water mist was doubtless due to one or both of the following causes—namely: the penetration of the fire zone by water or the progress of the fire to a point where considerable water entered the shaft.

The diminution in the carbon monoxide was closely watched from day to day in the hope that the atmosphere in the Muldoon system below the 2,400-ft. level would clear sufficiently so that rescue parties could safely descend to the lower levels of the mine through this entrance. The atmosphere, however remained irrespirable up to the afternoon of Sept. 17, and early in the morning of the 18th, connection was made between the 3,600-ft. level of the Kennedy and the 4,200-ft. level of the Argonaut.

During the time of the exploration work and the removal of the bodies, gas samples were analyzed at frequent intervals, but there was no indication that the air entering the mine through the Kennedy connection caused any change in the fire zone.

CALCULATING THE EXTENT OF THE FIRE

One of the much-discussed subjects prior to the entrance of the Argonaut shaft through the Kennedy connection was the extent of the fire zone in the shaft and particularly the question as to whether the 4,200-ft. station in the Argonaut shaft would be found intact. On Sept. 4 the writer made a rough calculation of the amount of timber which had been burned up to that time, and at intervals after that this calculation was brought up to date. For the period covered by the gas analyses these calculations were based upon the volume and total carbon content of the gas coming up the Muldoon raise at the 2,400-ft. level. For the initial period of the fire, assumptions were made as to the volume of air entering the fire zone, and the extent to which the oxygen was consumed by the burning timber. According to data furnished by the management, the timber used in the Argonaut shaft corresponded to 1,200 lb. of wood per running foot of shaft. The wood was assumed to contain 50 per cent carbon. A summary of these calculations is given in Table II.

TABLE II—ESTIMATE OF SHAFT TIMBERING BURNED

Date	Time Interval in Hrs.	Assumed Air Vol. Cu. Ft. Per Min.	Basis of Calculation	Wood Consumed Lb. Per Min.	Total Tons	Corresponding Length of Shaft in Ft.
8-28	4	30,000	50% oxygen utilized	200	24	40
8-28	20	15,000	50% oxygen utilized	100	60	100
8-29	72	10,000	50% oxygen utilized	67	144	240
8-30						
8-31						
9-1 to 9-10	216	4,000	6.5% CO+CO ₂	17.6	114	190
9-10 to 9-19	216	4,000	5% CO+CO ₂	12	77.8	130
Total length of shaft timbering entirely consumed.....						706

The assumptions used in calculating the quantity of timber consumed during the early period of the fire before exact gas data were available were considered to be liberal. The computations based on gas data are fair approximations, but indicate only the quantity of timber totally destroyed. There was no way of knowing

whether the timbering in a single continuous section of shaft had been destroyed or whether partial destruction had occurred throughout a greater length of shaft. Balancing these several considerations, the writer expressed the opinion that not more than a thousand feet of shaft timbering had been involved and that consequently the 4,200-ft. station would be found intact. Subsequent explorations have shown that the shaft was not burned below the 3,700-ft. level, and it seems likely that the estimate will prove to be approximately correct.

THE VALUE OF GAS ANALYSES

As the events at the Argonaut were followed from day to day one was repeatedly impressed with the fact that the analyses and other observations of the gas stream coming up the return airway furnished the only means of judging what was going on in the fire zone. These observations not only showed that the fire had been placed under control by the bulkheads but also that it was being slowly extinguished. In this case the story told by the gas work is a relatively simple one. During the previous fire at the Argonaut in 1919 a somewhat similar program of gas sampling was carried out and on several occasions variations in the gas composition gave notice of occurrences underground which required immediate attention.

It is possible that the utility of the systematic determination of gas composition, gas volume, etc., in connection with mining operations has not been fully appreciated. Seepages of methane occur in certain formations and there are several cases on record where explosive mixtures of this gas with air have been formed in underground workings in California. Warning of such seepages might be obtained by analysis of the return air before dangerous quantities have collected. In a similar way, the influx of air high in carbon dioxide from old workings, due perhaps to movement of the ground or failure of an old bulkhead, might be detected. The underlying consideration is that an examination of the return air may yield information in regard to an occurrence at a remote point, thus giving notice of a condition which requires attention.

The New Chemical Element, Hafnium

In *Chemistry and Industry* for Jan. 26, we read of the discovery by Professors Coster and Hevesy, of Copenhagen, of a new element, called hafnium, after Hafniae, an ancient name for Copenhagen. The new element is homologous to zirconium and is apparently present in specimens of zirconium minerals to the extent of about 1 per cent. It has been discovered by means of its X-ray spectrum, and the method will in all probability be applied to advantage in the discovery of other elements.

For some years past the University of Copenhagen has made valuable contributions in the department of both physics and chemistry. The theories of Professor Bohr as to the structure of the atom and the calculations he has made of the orbits of the revolving electrons, have gained recognition and have assisted in solving the difficulties of the emission of ordinary bright-line spectra. The output of accurate determination of X-ray spectra by Professors Hjalmar and Coster and others has been considerable, and a complete survey of this interesting field of research is now being undertaken. The Scandinavian men of science seem to abound in genius as do their minerals in elements!

What Happens During Fermentation?

Some Recent Developments Which Have Given Us a Better Insight Into Various Biochemical Processes of Industrial Importance

BY F. F. NORD

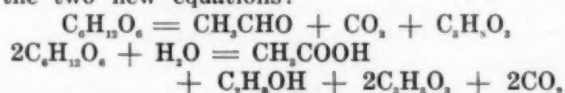
Doktor Ingenieur, Berlin

THE fermentation industries stand foremost in importance among the technical consumers of agricultural products. Tremendous quantities of alcohol, lactic acid, butanol, acetic acid and other chemical materials are prepared from carbohydrates with the help of micro-organisms. Although we are intimately acquainted with these final products and with the raw materials from which they are obtained, we have only begun the research which, with the aid of organic chemistry, will penetrate into the real nature of these reactions.

This work has, however, already led to significant and important results. Among the more recent developments I need mention here only the discovery of the pyroracemic acid fermentation and the sugar-free fermentations and the new theory of alcoholic fermentation arising from these discoveries. This work has led to supplementing Gay-Lussac's classic fermentation formula of 1810



by the two new equations:



Expressed otherwise, it may be said that sugar is split up into acetaldehyde, glycerine and carbonic acid as well as transformed into alcohol, acetic acid, glycerine and carbonic acid.

THE INTERMEDIARY STAGE

From fermentation practice we know that one molecule of sugar yields two molecules of ethyl alcohol and two molecules of carbonic acid without so much as the slightest indication of either C_2H_5- or CO_2- groups existing in the sugar. This is a typical example of a reaction which is possible only by passing through intermediary stages. This view is not a novel one. It has obtained for 30 years and yet search for these intermediary stages was unsuccessful until the fermentability of pyroracemic acid was definitely established.

This study is bound up with that of the activity of the enzyme *carboxylase*, contained in the complex *zymase* that splits the sugar into alcohol and carbonic acid.

Pyroracemic acid, which might potentially be present in grape sugar and in other fermentable carbohydrates, is split into acetaldehyde and carbonic acid according to the following simple equation:

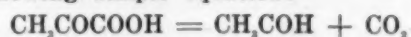


TABLE I—RELATION OF SODIUM SULPHITE CONTENT TO GLYCERINE YIELD

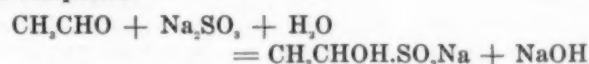
Proportion of Sodium Sulphite to Sugar (Per Cent)	Yield of Glycerine in Per Cent of Theoretical
40	23.1
67	24.8
80	27.3
100	30.1
120	33.1
150	34.6
200	36.7

Here then we have bodies in which carboxyl and ethyl remnants are found and how they came into existence is no longer a subject for speculation, but can be demonstrated experimentally. The facility with which pyroracemic acid yields to this characteristic division into acetaldehyde and carbonic acid makes it immaterial biologically whether, in fermentation processes, acetaldehyde and carbonic acid as such are assigned their function, or whether it be in the form of their union as pyroracemic acid.

COMMERCIAL PRODUCTION OF GLYCERINE

Outstanding among the practical achievements in the fermentation field is the commercial production of glycerine in Germany by Connstein and Ludecke. The great dearth of glycerine among the Central Powers (following the cutting off of imports of fats and oils) and the demand for military purposes prompted the theoretical researches which eventually led to this process.

Sugar was available as a raw material and accordingly every effort was concentrated on its fermentation. Previously this had been conducted only in neutral or faintly acid solution. Knowledge of the facile formation of acetaldehyde which has previously been referred to, and the work of Bunte and later of Kerp on sodium acetaldehyde sulphite, suggested the possibility that by successfully removing the acetaldehyde in the form of that compound



some glycerine might be formed provided suitable conditions for the fermentation were maintained. In the first experiments a number of compounds of alkaline reaction were used such as disodium phosphate, sodium carbonate, sodium acetate and sodium bicarbonate. However, these gave rise to the growth of a great many lactic-acid bacteria, which, while flourishing in the alkaline nutrient medium, not only consumed large quantities of sugar but also were the cause of an impurity which was difficult to remove from the resulting glycerine.

The alkaline salts were next replaced by disodium sulphite. This salt, when added to the mash even in very considerable quantities, does not inhibit fermentative action of the yeast and in addition is a valuable antiseptic.

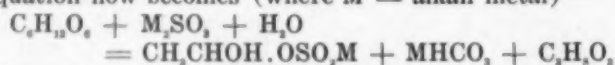
The manner in which the yields of glycerine increase with increasing amounts of this salt may be observed from the figures in Table I.

It is of significance to note that during the war the monthly production of glycerine by this method exceeded 2,000,000 lb. and the yield was 20 to 25 per cent.

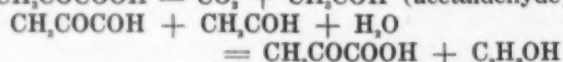
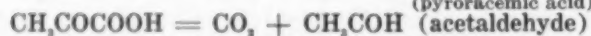
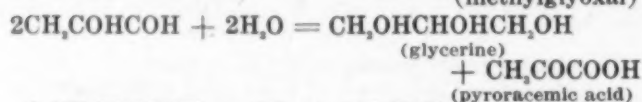
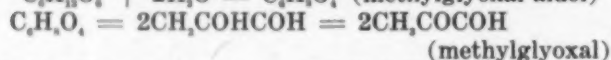
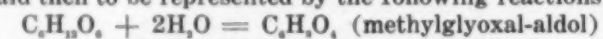
THE THEORY EXPLAINED

With such commercial results attained, fresh impetus was given to attempts at the theoretical explanation of the reactions involved. The way was shown by C. Neuberg and E. Reinfurth, who in their very extensive investigations proved that the secondary sulphites enter into a very loose combination with sugar which in aqueous solution undergoes almost complete dissociation. The resulting sulphite complexes with aldehydes are more stable, especially the sulphite-acetaldehyde combination. With any amount of sulphite employed, the quantities of acetaldehyde and glycerine produced are found to be in relation of 1:1 mol. As regards

the participation of the sulphite, the ideal fermentation equation now becomes (where M = alkali metal)



The generation of acetaldehyde and glycerine may be said then to be represented by the following reactions:



In normal alcoholic fermentation the final phase means a reduction of acetaldehyde to ethyl alcohol. By fixing the acetaldehyde in the form of a sulphite complex ($CH_3CHOH.OSO_2M$) it is withdrawn from the final phase of hydrogenation and inasmuch as free hydrogen is not being generated, another reduction product, glycerine, is formed in equivalent amount. The more sulphite present the more acetaldehyde is held and consequently the more glycerine can be produced.

In studying these reactions one is impressed with the strategic position held by the pyroracemic acid and by acetaldehyde. The whole series of equations is based on the assumption that initially two molecules of water are split off to form methylglyoxal—the first product with three atoms of carbon in the molecule. All further rearrangements amount to repeated transformations of methylglyoxal in conformance with the Cannizzaro reaction. In the first, pyroracemic acid is formed, and, taking up water, glycerine.

The pyroracemic acid having been dissociated into carbonic acid and acetaldehyde through the action of the enzyme carboxylase, acetaldehyde is present for the second reaction with methylglyoxal (also an aldehyde). After the single Cannizzaro reaction had been confirmed through a number of observations and the succeeding internal rearrangements established biochemically, it stood to reason that this reaction represented a step in the intermediary processes of alcoholic fermentation.

The question now arose as to whether the mixed transformations between simple aldehydes, such as are set forth in the preceding equations, could actually be effected. The author put the question to experimental proof and obtained an affirmative answer. He succeeded in bringing about this transformation between two aliphatic aldehydes and also between one aromatic and one aliphatic component. This was accomplished by employing a suitable catalyst, and a series of investigations completely confirmed this explanation.

STUDY OF *B. COLI* FERMENTATION

With the successful use of disodium sulphite in yeast fermentation, a fresh impetus was given to investigations on the metabolic procedures in the case of other micro-organisms.

Nature offers in the widely occurring *B. coli* an instance of carbohydrate fermentation on a vast scale. This agency is not limited to the sugars proper, but is concerned with related substances as well—for instance, with mannite and glycerine.

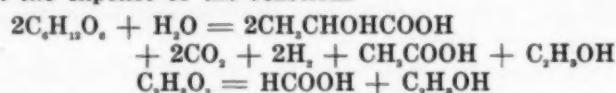
It will be recalled that the yeasts are comparatively resistant to the alkaline sulphites, which, as we have seen in the case of glycerine, contribute to the mechanism of the reactions by assuming the rôle of a binding agent. In applying this principle in the case of

bacteria, however, conditions were altered, in so far as the sulphite of an alkaline earth, such as calcium sulphite (with a neutral reaction), was used instead of the secondary sulphites of sodium or potassium (of alkaline reaction).

Calcium sulphite offers advantages not only because of its neutral reaction but also because of the fact that, since it is insoluble in water, osmotic action harmful to sensitive organisms is avoided. A disadvantage, however, lies in diminished concentration of sulphite-ion, although this may in a measure be overcome by agitation.

The rôle of acetaldehyde as a transition factor in fermenting dextrose and glycerine by means of *B. coli* has been proved where the calcium sulphite modification has been employed.

Here too acetaldehyde is formed (40 to 45 per cent of the corresponding amount of ethyl alcohol) plainly at the expense of the reactions



which in a normal *coli* fermentation result in the alcohol.

Similarly, acetaldehyde as an intermediate product is met with in other fermentation reactions such as those responsible for putrefaction and also in the citric acid and fumaric acid fermentations.

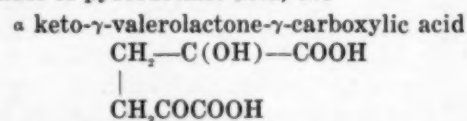
All of the preceding fermentations by yeast or bacteria are of an anaërobic character. It should, therefore, be of interest to study the *modus operandi* in a fermentation where atmospheric oxygen takes a part. An example is the production of acetic acid, which is closely related to the different sugar fermentations. This is not only because many organisms will form acetic acid from carbohydrates, but also because in the acetic oxidation we see the alcohol, after certain organisms had produced it from sugar, further transformed by means of another organism. And, too, the sulphite "blocking" of acetaldehyde in order to arrest the sugar fermentation in an intermediary stage has also been accomplished in the case of vinegar. From one-third to three-fourths of the acetic acid formed by the reaction could be removed in the form of acetaldehyde. These results were obtained from extensive experimental investigations with wine and vinegar bacteria, especially *B. ascendens* and *B. pasteurianum*.

In practical vinegar making traces of acetaldehyde not infrequently are found, especially in those cases where by faulty operation there has been an accumulation of alcohol with an insufficient air supply.

BUTYRIC ACID AND ALCOHOL FERMENTATION

The formation of acetaldehyde as an intermediate in butyric acid fermentation has been well proved. By using *B. butyricus* Fitz in the presence of disodium sulphite, 11.8 per cent of the aldehyde has been shown to have been formed. The acetaldehyde and its aldol when acted upon by this bacillus yield ethyl alcohol and acetic acid instead of butyl alcohol and butyric acid. Although the pyroracemic acid is fully utilized for supplying carbon, yet only traces of butyric acid are formed.

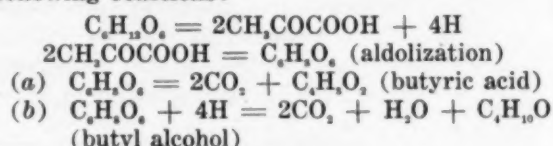
The aldol of pyroracemic acid, the



(condensation product of two molecules of pyroracemic

acid) yield considerable amounts of butyric acid when acted upon by the *B. butyricus* Fitz.

How pyroracemic acid functions as an intermediate product in this complex process is made apparent by the following reactions:



Thus it will be seen that acetaldehyde occupies a position of great biological importance.

It has been isolated from many different carbohydrate fermentations. There have been vague indications of the presence of aldehydes in physiological processes, but almost without exception evidence has been lacking as to the kind of aldehyde present. In cases where acetaldehyde has been definitely isolated its presence has been explained as a secondary oxidation of ethyl alcohol. It is well known that alcohol will form acetaldehyde under a number of circumstances, such as by contact with porous bodies, by exposure to light and by various metallic surfaces in presence of air. Such qualitative traces as were noted in normal fermentations were explained also as secondary oxidation of alcohol. However, this would not account for such amounts as are indicated in the sulphite fermentation—viz., 75 per cent of the alcohol present.

Volume Changes During Hardening

In the course of the investigations conducted by Howard Scott at the Bureau of Standards for the gage steel committee, an attempt was made to locate the principal source of distortion during hardening. Gage specimens made of a high-nickel steel, containing 0.11 C, 0.89 Mn, 0.19 Si and 31.0 Ni (which has no hardening transformation), were quenched in water from 800 deg. C. and the following changes noted:

No.	Length (In. $\times 10^{-3}$)	Diameter (In. $\times 10^{-3}$)		
		Left	Center	Right
I 21	-0.08	-0.16	-0.14	-0.14
I 22	-0.11	-0.33	-0.43	-0.46

I 21 was silver plated and I 22 unprotected, so it was necessary to pickle the latter specimen, which circumstance probably accounts for the greater decrease in size. The changes are, however, very small, perhaps within the limits of reproducibility, so the effective changes must be associated with the true hardening transformation called by Scott Ar".

The hardening transformation occurs in tool steels at a temperature below 300 deg. C. and is sometimes not complete at ordinary temperatures. It involves a considerable change in volume of the steel and this suggests that the dimensional changes may be controlled by the rate of cooling through this range. An increase in volume cannot be avoided if high hardness is desired, so the problem of dimensional changes resolves itself into the problem of producing uniform dimensional changes in all directions. Two obvious courses are open for accomplishing this; either to use a deep hardening steel and cool slowly through the hardening transformation, thereby permitting it to progress uniformly through the whole mass, or to harden only the surface layers of the steel. The latter expedient introduces a variable which is very difficult to control.

A chromium-bearing steel containing 1.00 per cent carbon and 1.34 per cent chromium is much used for

gages, and experiments were made as outlined in the following table:

Quenching Temperature, Deg. C.	Nature of Bath	Temperature of Bath, Deg. C.	Change in Length In. $\times 10^{-3}$
825	Oil	130 to 90*	2.05
840	Oil	23	4.48
840	Liquid Air		6.22
830	Oil	140	5.47
840	Oil	140	8.27
800	Water	23	15.65

Taking 2 hours.

To reveal distortion, the change in length is calculated from the change in specific volume, giving the total length change for uniform change in all directions. Differences between these values and the values for length change are then a measure of distortion. The distortion for water quenching is very marked, the actual length change being more than twice the computed change. There is, however, little distortion on oil hardening, though cooling rapidly from the oil quenching bath at 140 deg. C. appears to cause greater distortion than cooling slowly from that temperature.

The conclusion should not be drawn, because the oil-quenched specimens show less distortion than the water-quenched specimens on hardening, that they will necessarily show less dimensional change with time. In fact, from the indications so far, the opposite appears to be true—i.e., that the water-quenched specimens change less with time.

The volume change is about 0.5 per cent for water quenching and probably represents the maximum for full hardening. Certain of the oil-quenched specimens show as great a volume change as this, but it is doubtful whether the hardening has penetrated to the center. 1½-in. diameter specimens of this chromium steel quenched in oil from 1,000 deg. C. show only a surface layer of martensite, but penetration to the center on water quenching.

Oil quenching evidently produces little distortion, but that it gives maximum hardness is open to question. None of the specimens listed in the table showed full file hardness, while those quenched in oil from 800 deg. C. were distinctly soft and probably not martensitic even on the surface.

Fertilizer Industry Consumes the Largest Quantity of Sulphuric Acid

Eliminating the amount of sulphuric acid used for munitions and allowing about 200,000 tons for peacetime explosives, an indicated requirement of 5,010,000 tons for normal peace industries is arrived at. The normal amount of sulphuric acid used for explosives would thus be less than the quantity used in the metallurgical industry, including the manufacture of storage batteries, but more than the quantity used for paints, lithopone and glue. Fertilizers head the list as taking the largest quantity. However, the need for so much acid in the summer of 1918 operated to reduce the amounts used for other purposes, for pre-war consumption in the manufacture of phosphate fertilizer was about 2,300,000 tons a year and it has since grown to more than 2,500,000 tons, or over half the total. Moreover, it is to be noted that ammonium sulphate, and probably other products classified with "chemicals, drugs and ammonium sulphate," are themselves used for fertilizers or to make fertilizers, so that without doubt the fertilizer industry is normally by far the greatest user of sulphuric acid.

Structure of Chromium-Nickel Steel

BY H. B. PULSIFER AND O. V. GREENE

Assistant Professor Metallurgy, Lehigh University, and
Metallurgist, Philadelphia & Reading R.R. Co.

A Series of Micrographs Fail to Show Any Change in Structure in Quenched Cr:Ni Steel After Various Draws, Despite Large Differences in Physical Properties—Precautions Needed in Etching and Photographing

WE had available a series of 1-in. round bars manufactured in the basic open-hearth by the Bethlehem Steel Co., of the following analysis:

	Chromium-Nickel S.A.E. 3240	Chromium-Molybdenum
Carbon	0.38	0.46
Manganese	0.52	0.72
Phosphorus	0.018	0.028
Sulphur	0.034	0.031
Silicon	0.20	0.23
Chromium	1.08	1.07
Nickel	1.87
Molybdenum	0.35

Physical properties after a variety of heat-treatments had been studied in a graduation thesis by former students, and found to be very similar to those given for similar material by H. J. French in *Metallurgical & Chemical Engineering* of Oct. 15, 1917, and in the Society of Automotive Engineers' Handbook. The chromium-molybdenum material is distinctly superior to the chromium-nickel.

Both steels were normalized by heating to 1,600 deg. F. during 16 hours, soaking 8 hours, and slow cooling. Preliminary fracture tests of quenched pieces heated to every 50 deg. interval from 1,400 to 1,600 deg. F. indicated 1,500 deg. as giving the finest grain and the smoothest fracture.

The test pieces were cut in 5-in. lengths; eight specimens were quenched in oil and eight were quenched in water after holding at 1,500 deg. F. for an hour. The pieces of each series were then drawn at 100 deg. intervals from 600 to 1,300 deg. F.

Preliminary examination at 100 diameters for struc-

ture was made after the usual brief etching with stock picric acid solution. These showed a martensitic structure with the grain boundaries imperfectly disclosed. (Fig. 6.) Archer's method¹—etching in freshly prepared 4 per cent picric acid in ethyl alcohol for several minutes, and then rubbing off the carbonaceous smudge on moist broadcloth—was then used by Mr. Greene and each specimen was photographed at a thousand diameters magnification. The conspicuous development of the cellular structure requires several minutes immersion in the picric acid solution and either a too brief or a too long period fails to give the network clearly. The cellular texture is always present in the chromium-nickel series; we find in chromium-molybdenum steels it is more difficult to get the network sharply and it is also obscured by an apparent change of the martensitic stock to troostite about the grain boundaries.

The microscopic structure of the chromium-nickel samples appears to be a uniform cellular martensite; this means that the martensite obtained by the quenching has not been changed microscopically by the tempering operation. It is well known that the tempering operation alters the physical properties enormously and the tempered specimens etch more easily as the temperature of the drawing is increased, but in this chromium-nickel series the microscopic appearance at 1,000 diameters magnification is not changed. There is no evidence that the cellular nature, or the grain structure, has been affected in the slightest. Fig. 1 is a typical print. We fail to find any noticeable difference in the ground-mass, the size of the grains or the width of the grain boundaries as the drawing temperature

¹Archer, *Trans., A.I.M.E.*, vol. 62, p. 754 (1920).



FIG. 1—Cr-Ni, OIL QUENCHED AND DRAWN TO 1,200 DEG. F.
1,000 dia. 12 min. etch. Leitz microscope. Cellular martensite.

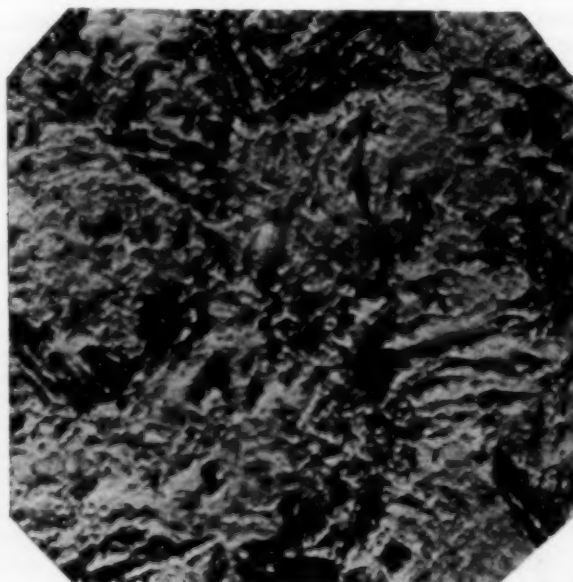


FIG. 2—Cr-Mo, WATER QUENCHED AND DRAWN TO 1,300 DEG. F.
1,000 dia. 5 min. etch. Pellin-Zeiss microscope. Shows dark troostite appearing in spots.



FIG. 3—Cr-Ni, WATER QUENCHED AND DRAWN TO 1,000 DEG. F.
250 dia. 15 min. etch. Pellin-Zeiss microscope. Cellular martensite.

has been raised. Since the physical and chemical properties have changed very greatly, we must infer that the atomic readjustments caused by the heating are sub-microscopic.

We doubt if there is any component which could be called troostite in this series, even at draws as high as 1,300 deg. F. Thus Seidell and Horvitz² give a print of a very similar structure and call the ground-mass martensite "surrounded by troostite envelopes." If the grains were bounded by troostite, or if troostite began to form at the lower drawing temperature, the amount of that component should increase with the temperature of drawing.

In the chromium-molybdenum steel there is much more evidence of the formation of troostite. The two specimens drawn at 1,300 deg. F. after quenching in oil and water respectively show considerable amounts of a second component (Fig. 2). This second com-

²Seidell and Horvitz, "Physical Qualities of High-Chrome Steel," *Iron Age*, Jan. 30, 1919.

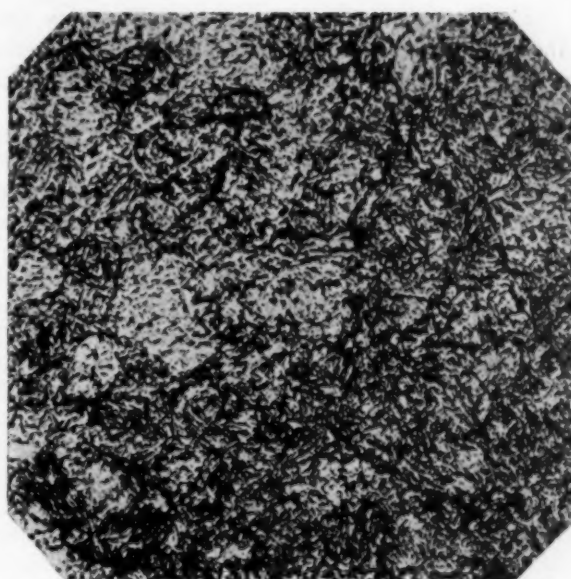


FIG. 4—Cr-Ni, OIL QUENCHED AND DRAWN TO 1,100 DEG. F.
500 dia. 11 min. etch. Pellin-Zeiss microscope. Cellular martensite.

ponent etches out dark in the picric acid solution, its granules are extremely fine and it likely corresponds to the troostite of the simple carbon series.

Prolonged efforts were made to develop the cellular structure of the chromium-molybdenum stock as completely as was done with the chromium-nickel material. Although traces of units were always apparent and individual grains could easily be known from the arrangement of the striations, no particular success was obtained. Fig. 2 is characteristic of the general results in this respect. Possibly the suppression of the definite grain outlines of each particle has its physical expression in the enhanced strength of the steel³.

Fig. 3 is a 250-diameter print from the water quench chromium-nickel bar drawn to 1,000 deg. F. This bar had a very perfect cellular texture, so that pictures were more easily obtained than from any other specimen.

³Elastic limit and ultimate strength for the quenched Cr:Ni steel, tempered at 1,300 deg. F., are 70,000 and 110,000 lb. per sq. in., but 80,000 and 120,000 for the Cr:Mo steel.

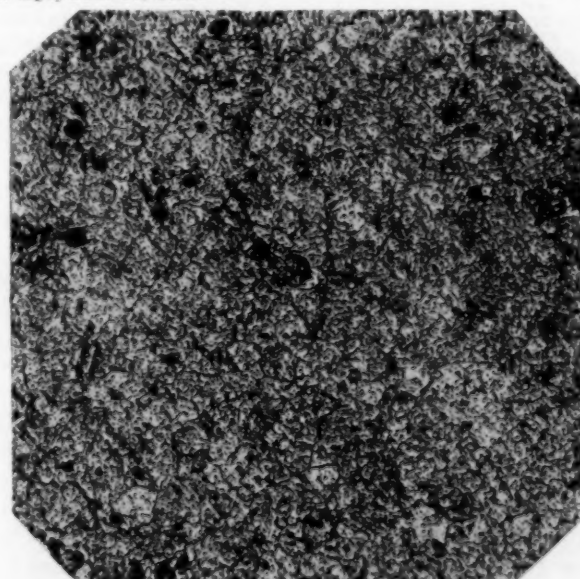


FIG. 5—Cr-Ni, OIL QUENCHED AND DRAWN TO 1,300 DEG. F.
100 dia. 8 min. etch. Pellin-Zeiss microscope. Cellular martensite.

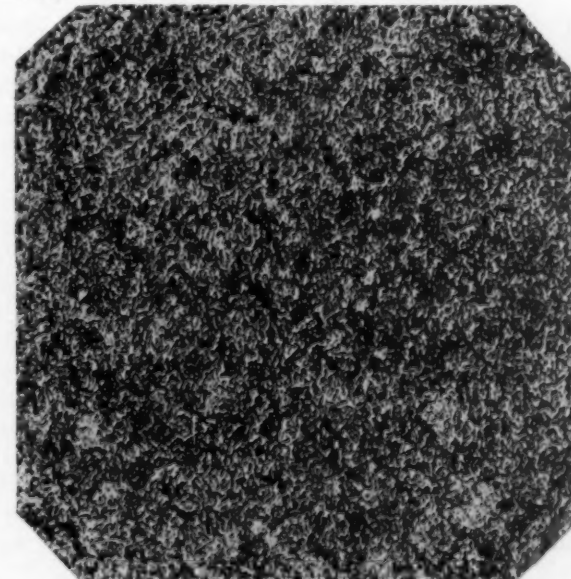


FIG. 6—Cr-Ni, WATER QUENCHED AND DRAWN TO 1,100 DEG. F.
Short etch with stock solution. 100 dia. Pellin-Zeiss microscope. Martensite grains imperfectly disclosed.

Fig. 4 is a 500-diameter print from the oil quench drawn to 1,100 deg. F. The grains appear less sharply defined, while there is slight evidence of any alteration of the martensite.

Fig. 5 is from a series of chromium-nickel specimens drawn to 900, 1,100, 1,200 and 1,300 deg. respectively. The fine-grained nature of all the stock is apparent from this print at 100 diameters; although the grain boundaries are sharp and distinct, it must be remembered that either a shorter or longer time in the etching than the optimum would leave the grains very indistinct. As evidence of how uniform the martensite is in the chromium-nickel series and to show the results of a brief picric acid etch we give Fig. 6 from the preliminary work. A casual inspection reveals that separate grains are present in the picture, but it is equally obvious that for sharpness or clean-cut delineation such etching cannot compare with that given in Figs. 1 to 5.

A final word may be offered as to pitting and tarnishing of the specimens during the etching, drying and photographing. The material is very prone to become pitted; round pit marks are only too conspicuous in Fig. 5. Only sharp and prompt work will keep them subordinated; it may often be necessary to repeat the final polishing and etching. Tarnishing is even more serious and difficult to overcome than the pitting. If any of the specimens stand exposed in the open air or even in a dessicator alteration of the surface begins quickly and spreads rapidly along the grain borders. The corrosion caused by exposure to air resembles a change to troostite; on this account all the specimens were photographed immediately after the polishing and etching. Specimens were resurfaced in case a photograph had to be repeated the next day.

It might be proposed that the extent of the tarnish might be used as an indication of a change from martensite to troostite, we do not doubt that the changes produced by the tempering have strongly altered some deep-seated forces in the chromium-nickel steel, and even the microscopic structure of the chromium-molybdenum steel, but it would be impossible to admit that a progressive tarnishing could define a structural constituent.

Patents and the Problem of Priority

An interesting aspect of the question of priority, reported in the Feb. 1 issue of *India Rubber World*, presented itself in the suit of the Dovan Chemical Co., Inc., plaintiff, against the National Aniline & Chemical Co., defendant. Judge Manton, in the United States District Court for the Southern District of New York, rendered decision in favor of the plaintiff, proclaiming that earlier and inadequate experiments should not be permitted to deprive the successful inventor of his due and just reward. The patent under discussion (No. 1,411,231) was applied for Nov. 12, 1921, and was granted March 28, 1922. It represents a method of improving rubber compounds so that the finished product shall be of superior quality and the time required for vulcanization be greatly lessened. The inventor of this process, Morris L. Weiss, has discovered that diphenyl guanidine not only hastens the vulcanization but results in a final product greatly improved in texture, durability and aging qualities to a much greater extent than when triphenyl guanidine is used.

The use of diphenyl guanidine results in greater elasticity and freedom from bloom. Moreover, it is also very valuable where it is desired to produce a

harder or less elastic portion in an article, leaving other parts more elastic and flexible, as in the case of automobile tires.

The defendant, however, urged that others prior to Weiss have tested diphenyl guanidine as an accelerator. At a meeting of the Chemical Society of Philadelphia, in September, 1919, George D. Kratz read a paper in which diphenyl guanidine was referred to as an accelerator. It cannot be claimed, however, that a mere reading of the paper before this society constitutes a statutory publication. Later, in 1920, there appeared in the *Journal of Industrial and Engineering Chemistry* a complete publication by Kratz and others. Although this was previous to the filing of an application by Weiss, it has been shown that the Weiss tests recorded in the spring of 1918 were previous to the reading of the Kratz paper. A careful examination of these tests proves that Weiss was the first to make adequate experiments and to solve the problem of producing diphenyl guanidine in commercial form. Kratz, on the other hand, claims to have made laboratory tests and later to have mixed 30 grams of diphenyl guanidine with rubber stock made into tubes for automobiles. These tubes were sold as imperfect rubber. The amount of acceleration used, however, could have had no substantial effect in the curing of the rubber, as compared with that used in the plaintiff's process, and an invention, to be patentable, should be complete and capable of producing new and useful results.

Utilizing the Waste of Grape Fruit Factories

There is a possibility of the practical and profitable commercial utilization of the stems and pomace from the grape juice factories which are thrown away. The average quantity of grapes crushed for beverage purposes in the 5 years from 1914 to 1918 was 22,000 tons. In this period an average of 660 tons of stems and 4,400 tons of wet pomace was discarded. From this quantity of waste it is claimed that, where the stems yield 2 per cent of cream of tartar, it is possible to secure 13.2 tons of this material.

After the seeds are separated the pomace can be made into a good grade of jelly by a simple process. Experts have calculated that 3,300 tons of wet skins would be available annually from the wet pomace, and it is estimated that this amount of waste would produce 19,800,000 8-oz. glasses of jelly. From this operation about 1,435 tons of dry residue would result which is of value as stock feed.

The grape seeds, comprising 5 per cent of the total weight of fresh grapes, or about 1,100 tons, can, after hulling and grinding, be manufactured into oil by two different methods known commercially as the pressure method and the solvent extraction method. The total oil content of the seeds is estimated at 13 per cent, not all of which can be successfully recovered. It is estimated that by means of the pressure method about 89.3 tons of oil and 526.7 tons of oil cake can be obtained. The 484 tons of hulls made available by this process is calculated to yield 48.4 tons of tannin extract. The solvent extraction method yields about 132 tons of oil with 968 tons of meal possessing a lower market value than the press cake from the pressure method. Refining, bleaching and deodorizing of the oil produce a palatable condimental oil with properties similar to those of the soy bean and cottonseed oil.

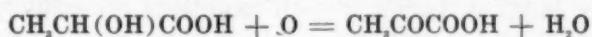
Pyruvic Acid From Lactic Acid

Significance of This Problem in Electrolytic Oxidation Is Discussed and Elucidated

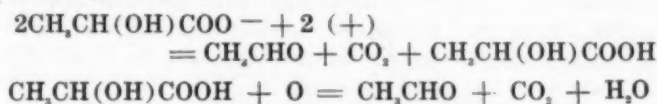
BY J. G. SMULL AND P. SUBKOW

W. H. Chandler Chemical Laboratory, Lehigh University

THE oxidation of lactic acid by purely chemical methods, not electrolytic, can be controlled so as to yield pyruvic acid, as represented by the equation



This can be accomplished either with KMnO_4 or with H_2O_2 , using $\text{Fe}_2(\text{SO}_4)_3$ as an oxygen carrier. The pyruvic acid may be further oxidized by H_2O_2 with or without a catalyst,² with the formation of acetaldehyde and carbonic acid. The oxidation of lactic acid by electrolytic means has been shown to proceed in the following stages:³



Rockwell⁴ has found that in the electrolytic oxidation of pyruvic acid, acetaldehyde and CO_2 are the final products of the reaction.

It was decided to investigate more thoroughly the electrolytic oxidation of lactic acid to see whether its transformation to pyruvic acid could be accomplished. Ordinary electrolytic oxidation of lactic acid proceeds mainly with the formation of acetaldehyde, formic and acetic acids, together with a large amount of CO_2 . The authors found that in acid solutions the aldehyde is oxidized to acetic acid, and in alkaline solutions to formic acid, corroborating the work of Heimrod and Leven.⁵ In both acid and alkaline solutions a large amount of CO_2 is liberated. It was found in our experiments that if certain precautions were taken to remove any pyruvic acid formed from the sphere of oxidation, the latter acid can be prepared electrolytically.

The cell employed in these tests was composed of anode and cathode compartments separated by a semi-permeable diaphragm, consisting of an ordinary porous cup. Arrangements were made for cooling and for stirring the anode portion. In all but the last experiment the electrodes were of platinum. In the last experiment a perforated lead sheet was used as the anode and an iron gauze as the cathode. The anolyte was stirred vigorously in order that the electrolyte at the anode be not impoverished during the oxidation.

OXIDATION IN ACID SOLUTION

Anolyte—75 cc. consisting of 27 per cent lactic acid; 20 per cent sulphuric acid; platinum anode, 75 sq.cm.; anode current density, 0.04 amp. per sq.cm.

Catholyte—20 per cent sulphuric acid; platinum wire cathode.

The current was passed until theoretically one-half of the lactic acid should have been oxidized to pyruvic

acid. The object was to keep the former in excess so as to favor its oxidation in preference to that of the reaction products. The depolarization was extremely poor and the current density had to be reduced to 0.0133 amp. per sq.cm. The oxidation proceeds with the formation of acetic acid and CO_2 . No pyruvic acid was detected.

OXIDATION IN NEUTRAL SOLUTION

It was thought that if some soluble salt of lactic acid were used, insoluble when converted into the corresponding pyruvic acid salt, it might be possible to remove any pyruvic acid formed from the sphere of oxidation. Copper lactate is soluble six parts in one hundred parts of water. The copper pyruvate is insoluble. Otherwise it was believed that because of the vigor of the oxidation any pyruvic acid formed was burned to CO_2 . The copper lactate was obtained by treating lactic acid with an excess of basic copper carbonate and filtering off the residue.

Anolyte—350 cc. of copper lactate, 6 parts in 100 cc.; enough $\text{Cu}(\text{NO}_3)_2$ was added to raise the copper concentration to 20 per cent; platinum anode, 150 sq.cm.; anode current density 0.04 amp. per sq.cm.; complete depolarization.

Catholyte—The catholyte contained 20 per cent copper as copper nitrate; platinum wire cathode.

The current was run long enough to oxidize theoretically one-half of the lactic acid to pyruvic acid. The copper concentration in the anolyte was kept high so that the copper lactate was not impoverished, in copper, during electrolysis. The oxidation products were acetaldehyde, acetic acid, formic acid and CO_2 . An insoluble precipitate was obtained. This was filtered off, washed with water and dissolved in ammonia. The solution was made acid with acetic acid and phenylhydrazine added. The characteristic precipitate of the phenylhydrazine of pyruvic acid was obtained. Due to the slight solubility of copper lactate, the current efficiency was low. The oxidation of the lactic acid to CO_2 by the strong evolution of oxygen accounts for the complete depolarization noted.

OXIDATION IN ALKALINE SOLUTION

1. With insoluble anode:

Anolyte—125 cc. of 40 per cent sodium lactate solution containing 6 grams sodium hydroxide; platinum anode, 150 sq.cm.; anode current density 0.0133 amp. per sq.cm.; complete depolarization.

Catholyte—A 6 per cent solution of sodium hydroxide.

The current was passed long enough to oxidize theoretically one-half of the lactic acid to pyruvic acid. The concentration of sodium hydroxide in the anolyte was constantly diminished, due to electrolysis and to neutralization by the CO_2 liberated in the oxidation. The hydroxide concentration in the anolyte was maintained during the process by addition of caustic soda solution from time to time. The depolarization was complete. The oxidation proceeds, mainly, with the formation of acetaldehyde, formic acid and CO_2 . No pyruvic acid was detected.

2. With attackable anode:

The use of platinum anodes which have a high oxygen overpotential insures an extremely vigorous oxidation. It was thought that a more mild oxidation might result in a greater yield of pyruvic acid. Lead is at the other end of the electromotive series from platinum with respect to its oxygen overpotential. For the same current density, the lead would give a very much milder

NOTE: The authors wish to acknowledge their indebtedness to the Callender-Carnell Fellowship in Chemistry which made this investigation possible.

¹Beilstein and Wiegand, *Ber. der Deutsch. Ch. Gesell.*, 1884, vol. 17, p. 840.

²Fenton and Jones, *J. Chem. Soc.*, 1900, vol. 77, pp. 70-71.

³Kolbe, *Liebig Annalen*, 1860, vol. 113, p. 244. Miller and Hober, *Ber. der Deutsch. Ch. Gesell.*, 1894, vol. 27, p. 468. Walker, *J. Chem. Soc.*, 1896, vol. 69, p. 1278.

⁴Rockwell, *J. Chem. Soc.*, 1902, vol. 24, p. 719.

⁵Heimrod and Leven, *Ber. der Deutsch. Ch. Gesell.*, 1908, vol. 41, p. 4446.

oxidation.⁶ The lead is oxidized to PbO, which is dissolved by sodium hydroxide. This oxidation would further reduce the oxygen concentration at the anode and thus reduce the vigor of oxidation. Lead is made more useful, since, though lead pyruvate is soluble in water, it was found that it is converted on standing into a basic salt, insoluble in water or acetic acid. This hydrolysis would be facilitated by an alkali, and thus insure the removal of the pyruvic acid from the zone of oxidation.

Anolyte—27 per cent sodium lactate solution made alkaline with sodium hydroxide; perforated lead anode; anode current density 0.0074 amp. per sq.cm.

Catholyte—A 6 per cent sodium hydroxide solution; iron wire gauze cathode.

The depolarization in this experiment was complete. The current was passed until the lead was entirely corroded. This happened when only one-quarter of the lactic acid could have been theoretically oxidized. The lead was converted into PbCO₃, which analyzed 74.3 per cent Pb. The current efficiency of corrosion was about 95 per cent.

The lead carbonate was washed clean, decomposed with acetic acid and the insoluble residue treated with strong caustic soda in which it was soluble. The solution was made acid with acetic acid and gave the test for pyruvic acid with phenyl-hydrazine.

The anolyte after filtering contained no acetaldehyde. On extraction with ether no acetaldehyde ammonia could be detected when NH₃ was passed through the cooled ether solution. Upon evaporation of the ether a reddish resin of the type formed by the polymerization of acetaldehyde in alkaline solution was obtained. Acetic and formic acids were found. The anolyte no doubt contained some pyruvic acid due to the solution of some of the basic lead pyruvate in the alkali. An attempt to remove the pyruvic acid by acidification with acetic acid and steam distillation gave uncertain results, with the phenyl-hydrazine test.

IMPORTANCE OF PROCESS

It has been shown⁷ that the simultaneous electrolysis of the alkali salts of pyruvic acid and other fatty acids yields higher ketones, in satisfactory amounts. The technical importance of the higher ketones as organic solvents has long been appreciated. However, the commercial significance of the above electrolysis depends on a cheap source of pyruvic acid.

Another use for pyruvic acid is found in the synthesis of "atophan," or as it is sometimes called, "cincophan," one of the most important remedies for rheumatism. "Atophan" is a condensation product of pyruvic acid, benzaldehyde and aniline. The cost of pyruvic acid, made by the present method of the dry distillation of tartaric acid, is one of the large items in the cost of this pharmaceutical.

The above considerations make a source of relatively cheap pyruvic acid of prime importance. The present supply of lactic acid, at a low cost, increases its interest as an intermediate in the preparation of pyruvic acid. With this view in mind, this investigation was begun. The results included in this paper are given only as preliminary, indicating that pyruvic acid can be ob-

tained by an electrolytic oxidation of lactic acid, the yields being dependent upon careful control.

SUMMARY

1. The electrolytic oxidation of lactic acid in acid, neutral and alkaline solutions has been studied. In the latter case both soluble and insoluble anodes were used.

2. It was found that if care is taken to remove any pyruvic acid formed from the sphere of oxidation as an insoluble salt or if care is taken that the oxidation is kept mild, or, better, if both conditions are combined, pyruvic acid is obtained.

Properties and Tests of Tar Creosotes

Creosote is widely used as a preservative because of its chemical, physical and toxic properties. The literature on it, however, is widely distributed in technical periodicals, society proceedings and government reports. It is very fortunate, therefore, to have available a comprehensive résumé of the information in all this literature in the publication of the U. S. Department of Agriculture Bulletin 1036, entitled "Coal-Tar and Water-Gas Tar Creosotes: Their Properties and Methods of Testing," by Ernest Bateman, chemist of the Forest Products Laboratory.

This bulletin not only gives a most comprehensive, well-organized review of previous work, but also includes the first publication of the results of research which have been carried out for the purpose of obtaining a broader knowledge of the variations of creosote with different processes of manufacture.

The bulletin is divided into four parts. Part I includes the introduction, a description of tars, and an account of the manufacture of creosote. Part II is a presentation for the first time of the results of research by the author and his co-workers in the Forest Products Laboratory. Part III gives a summary of the chemical, physical and toxic properties of creosotes as a whole. Part IV is concerned entirely with methods of testing and specifications.

Copies of the bulletin can be obtained from the Government Printing Office, Washington, at 20 cents each.

Molding Sands

An investigation on molding sands, its reclamation and re-use, has been under way for some time under the active co-operation of a number of members of the American Foundrymen's Association. Standardization of tests for determining size, shape, cohesiveness, permeability, water content, thermal properties and analyses (including rational, chemical, mineralogical) are still under way and some of them are completed. The Ohio Brass Co. is making investigations for the use of clay in retaining bond strength in molding sand heaps. The Siver Steel Casting Co. of Milwaukee, is studying the effect of clay additions on the grain size of sand heaps. The American Steel Foundries Co. has reported on the method and equipment designed, which permits a recovery of about 70 per cent of refuse sand used in steel foundry work. Cost figures show that reclaimed sand costs about \$1 per ton, against new sand at the plant at \$2.65 to \$3.85 a ton. The process involves cleaning the sand grains of adhering fused material, then separating by air currents the good sand from the bad material.

⁶Coeh and Osaka, *Z. anorg. Chem.*, vol. 34, p. 86; Russ, *Z. phys. Chem.*, 1903, vol. 44, p. 641.

⁷Hofer, *Ber. Deutsch. Chem. Ges.*, pp. 33, 650 (1900); Mayr, "Electrosynthese aliphatischer und Aromatischer Ketonverbindungen," Dissertation, München Technische Hochschule (1904), and Rockwell, *J. Chem. Soc.*, vol. 24, p. 719 (1902).

Fundamentals of Rectification

Methods of Operating Which Affect Limiting Composition of Binary Liquids

For Example, the Introduction of Liquid or Gaseous Compounds at Intermediate Levels

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UP TO this point in our discussion we have not considered the ways and means available for producing either the liquids descending or the vapors ascending in the column.

In the actual operation of a rectification system, particularly when we are dealing with a gaseous mixture which must be liquefied at a temperature much below atmospheric, it is of very great importance that the liquefaction be accomplished as far as possible by permitting the heat necessary to be abstracted to flow into the liquids to be evaporated.

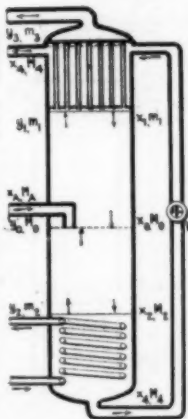
One common method of providing both the liquid descending and the vapor ascending in the column is that of admitting the mixture, either liquid or gaseous, at an intermediate level and condensing directly in the upper regions thereof a portion of the ascending vapors and vaporizing directly in the lower regions thereof a portion of the descending liquid.

We shall later on show how this condensation and evaporation must be distributed along the length of the column in order to cause the relation between x and y at all levels to be that for phase equilibrium. Actually to accomplish this result exactly is always impracticable, however, on account of the impossibility of distributing in the required manner in the column the various coils required to furnish or abstract the heat necessary at the various levels. For this reason it is usual to concentrate the vaporizing or condensing effect in certain limited regions in the column by the use of condensers and vaporizers therein.

The arrangement and location of these parts of the apparatus is always a matter of the greatest importance, inasmuch as some possible arrangements may impose severe restrictions upon the compositions possible to be attained in the separated products.

An example of such an arrangement which may be considered with profit in the present connection, where liquid is supposed to be admitted at an intermediate point in the column, is the one illustrated.

In this case, we have a liquid of mass M_A , composition x_A , entering a rectification column at the top of which is a condenser formed of parallel vertical tubes through which the ascending vapor passes, being partly liquefied therein. This liquefaction is accomplished by surrounding said tubes with a liquid M_1 of composition x_1 , constituted by the liquid leaving the vaporizer of the column after the pressure thereof has been lowered sufficiently in valve V to cause that condensation. The vapor ascending in the column is produced by evaporating at the bottom thereof a portion of the descending



liquid M_1 by means of a coil therein. As before, x_1 is the composition of the liquid M_1 , descending in the column at the level of admission of M_A , and we assume, furthermore, that the composition y_1 of the vapor m_1 , ascending at this level is that for phase equilibrium with the liquid of composition x_1 , if $x_1 > x_A$, or with those liquids combined if $x_1 < x_A$. As before, M_1 represents the liquid entering the top of the rectification column proper, in this case delivered by the tubes of the condenser, while m_1 represents the vapor of composition y_1 , entering the tubes of said condenser.

Let m_2 be the mass of uncondensed vapor residue leaving the top of the condenser and y_2 its composition. Then with the arrangement shown in the figure, eleven equations may be written, all homogeneous in the nine (M, m) 's. Ten of these equations are as follows:

$$\begin{aligned} m_1 &= m_2 + M_1 \\ y_1 m_1 &= y_2 m_2 + x_1 M_1 \\ m_2 + M_1 &= m_1 + M_2 \\ y_1 m_2 + x_1 M_1 &= y_2 m_1 + x_2 M_2 \\ J_1 m_2 + I_1 M_1 &= J_2 m_1 + I_2 M_2 \\ m_2 + M_A + M_1 &= m_1 + M_3 \\ y_1 m_2 + x_1 M_A + x_1 M_1 &= y_2 m_1 + x_2 M_3 \\ J_1 m_2 + I_1 M_A + I_1 M_1 &= J_2 m_1 + I_2 M_3 \\ M_3 &= m_3 + M_4 \\ x_3 M_3 &= y_3 m_3 + x_4 M_4 \end{aligned}$$

These ten equations hold independently of the method employed to accomplish the condensation in the tubes of the condenser and are true even were that condensation produced by the employment of an extraneous liquid surrounding the tubes of the condenser. If the liquid M_1 is produced in the condenser by thermal contact of the ascending vapors therein with the evaporating liquid M_1 , as shown in the figure, an additional equation may be written which states that the heat abstracted from M_1 during condensation thereof equals the heat added to M_1 during the evaporation thereof after its pressure has been lowered in valve V .

The heat required to evaporate the liquid M_1 before the pressure thereof has been lowered in the valve V is $L_1 M_1$, where L_1 is the latent heat at constant pressure of the liquid M_1 at the pressure in the rectification column proper. The result of this evaporation would be the fluid M_1 in a condition of saturated vapor at the pressure P_1 before passing through valve V . If this saturated vapor were then throttled in valve V , and if after throttling it were neither superheated nor partly liquefied—i.e., still saturated—it would be in the condition in which it is in the actual case as it leaves the condenser after being evaporated therein.

In that case, if L_1 denotes the latent heat at constant pressure of the liquid M_1 at the pressure P_1 , our eleventh equation would be:

$$L_1 M_1 = L_2 M_2$$

since the total heat of M_1 remains constant during its passage through valve V .

If, however the saturated vapor M_1 at the pressure P_1 ,

*The first three articles in this series were published in the issues of Jan. 31 and Feb. 7 and 14, 1923.

should be partly liquefied when its pressure is released to that prevailing around the tubes of the condenser, then the heat required to evaporate M_i in the condenser is greater than $L_i M_i$, the latter being that required to evaporate the liquid M_i at the higher pressure P_i , and our eleventh equation would be:

$$L_i M_i = (L_i + \Delta) M_i$$

where Δ is a quantity depending upon the change of the latent heat of the liquid M_i when its pressure is decreased under conditions of constant "total" heat. We shall therefore take our eleventh equation to be:

$$M_i = K M_A$$

where, with the arrangement shown in the figure,

$$K = \frac{L_i + \Delta}{L_i}$$

If, however, the condensation of the liquid M_i in the condenser be accomplished independently of the liquid M_A , K may be regarded as a quantity whose value is determined by the amount of that condensation.

Now, since we have eleven homogeneous equations among nine (M, m)'s, we may by elimination of all (M, m)'s obtain three independent equations not containing any (M, m).

These three equations are as follows:

$$J_1 \frac{x_1 - y_1}{x_1 - y_1} - I_1 \frac{y_1 - y_2}{x_1 - y_1} = J_2 \frac{x_2 - y_2}{x_2 - y_2} - I_2 \frac{y_2 - y_3}{x_2 - y_2}$$

$$\frac{y_1 - y_2}{x_1 - y_1} + K \frac{x_1 - y_1}{x_1 - x_A}$$

$$J_1 - I_1 + (J_1 - I_1) \frac{x_1 - y_1}{y_1 - y_2} = \frac{1}{K} \\ (J_2 - I_2) \frac{x_2 - y_2}{x_2 - y_3} + I_2 - I_1$$

We note that the first one of these relations must be satisfied independently of the value of K —that is to say, independently of the method employed to produce the condensation in the condenser.

This being true, we may assume that the mass of liquid M_i produced in the condenser is the minimum possible amount for a given mass M_A , or what is the same thing, that the mass M_A is the greatest possible for a given M_i . We have shown above that under these conditions, if we are dealing with a mixture having the property of proportionality latent heats, $x_A = x_0$, and also that x_0 and y_0 , and also x_1 and y_1 , are compositions of liquid and vapor in phase equilibrium. In the particular case where $y_0 = 0$, the first of our three independent relations takes the form:

$$\frac{J_1 x_1 - I_1 y_1}{x_1 - y_1} = \frac{J_2 x_2 - I_2 y_2}{x_2 - y_2}$$

That is to say, if the points (x_1, y_1) and (x_2, y_2) on the x, y curve are not coincident, the function

$$\frac{Jx - Iy}{x - y}$$

must have the same value at the two points. For a mixture whose latent heat at constant pressure follows the proportionality relation as defined, the two points (x_1, y_1) and (x_2, y_2) necessarily coincide, whatever be the value of y_1 . In that case, the first relation becomes:

$$L_i \frac{y_1 - y_2}{x_1 - y_1} = L_0 \frac{y_0 - y_2}{x_0 - y_2}$$

where

$$L_i = L_B x_i + L_A (1 - x_i)$$

and

$$L_0 = L_B x_0 + L_A (1 - x_0)$$

But under these conditions,

$$\frac{y_0}{1 - y_0} = a \frac{x_0}{1 - x_0}$$

and

$$\frac{y_1}{1 - y_1} = a \frac{x_1}{1 - x_1}$$

Eliminating y_1 and y_0 , the first relation becomes

$$(x_0 - x_1) [L_B a x_1 (1 - y_1) + L_A (1 - x_0) (1 - x_1) y_1] = 0$$

which in general can be true only if $x_0 = x_1$.

This result shows that in general the section of the column between the lower end of the condenser and the level of inlet of M_A is inoperative and therefore the same result would be obtained if the liquid M_A be admitted just below the condenser.

With the notation indicated in the figure below our system of equations then becomes:

$$m_1 = M_1 + m_2$$

$$y_1 m_1 = x_1 M_1 + y_2 m_2$$

$$M_A + M_1 + m_2 = M_2 + m_1$$

$$x_1 M_A + x_1 M_1 + y_2 m_2 = x_2 M_2 + y_2 m_1$$

$$I_1 M_A + I_1 M_1 + J_2 m_2 = I_2 M_2 + J_2 m_1$$

$$M_2 = m_2 + M_1$$

$$x_2 M_2 = y_2 m_2 + x_1 M_1$$

$$M_1 = K M_A$$

This system of eight equations is homogeneous in the seven (M, m)'s and by elimination of all (M, m)'s, two independent equations may be obtained between the various (x, y, J, I)'s and K . These two equations are as follows:

$$\frac{y_1 - y_2}{x_1 - y_1} = K \frac{x_1 - y_2}{x_1 - x_1}$$

$$(J_1 - I_1) \frac{x_1 - y_2}{y_1 - y_2} = \frac{1}{K} (J_2 - I_2) \frac{x_2 - y_2}{x_2 - y_3} + I_1 - I_2$$

If we eliminate K from the second equation by means of the first equation, the second equation takes the form:

$$\frac{J_1(x_1 - x_1) - I_1(x_1 - y_1)}{x_1 - y_1} = \frac{J_2(x_2 - x_2) - I_2(x_2 - y_2)}{x_2 - y_2}$$

The value of x_1 as determined by the first equation is

$$x_1 = x_0 + K \frac{(x_0 - y_2)(x_1 - y_1)}{y_1 - y_2}$$



The equation shows that for given values of x_0 and y_0 , x_1 is greatest when K is as great and y_1 is as small as possible. Whatever be the value of K , the minimum possible value of y_1 is that for phase equilibrium with the liquid of composition x_1 , while for the arrangement as shown in the figure, the value of K is of the order of unity. Hence, under these conditions, the value of x_1 is limited and in general it will be impossible to make $y_1 = 0$ and $x_1 = 1$ together.

As an example, assume the mixture we are dealing with is of oxygen and nitrogen and let $x_1 = 0.21$. According to Baly's curves, $y_1 = 0.06$. Then if we assume that $y_0 = 0$ and $K = 1$, the maximum possible value of x_1 is

$$x_1 = 0.21 \frac{(0.21)(0.15)}{0.06} = 0.73\frac{1}{2}$$

This limitation upon the composition of lower end product obtainable is present only in case the reflux liquid is produced in the manner exhibited in the figure and does not exist if we have available any desired amount of some extraneous liquid cold enough, when fed into the condenser, to cause condensation of the vapor m_1 as the latter ascends in the condenser tubes.

The example discussed in the preceding paragraphs is instructive in that it shows the importance of analyzing the relations existing in any proposed arrangement of apparatus.

RECTIFIER WITH VAPOR FEED AT INTERMEDIATE LEVEL

Let us now consider the case where we admit a saturated vapor of composition y_0 at an intermediate point of the column, its mass m_A being the maximum amount possible under conditions of perfect rectification as heretofore defined. In what follows, we shall assume that the vapor m_A is added at a point in the column such that after it has been flowing steadily, the composition at this point of the vapor ascending from below is the same as the composition y_0 of the vapor admitted to the column at that point.

We shall find that, under these conditions, the quantity m_A is a maximum when the composition x_0 of the descending liquid at the level of admission of m_A is the same as that of the liquid having phase equilibrium with the vapor of composition y_0 .

Under these conditions the six following equations hold, in which M_0 is the mass of descending liquid passing per unit time the level of admission of the vapor m_A , and m_0 is the mass of vapor ascending from below at this level.

$$\begin{aligned} M_1 + m_0 + m_A &= M_0 + m_1 \\ x_1 M_1 + y_0 (m_0 + m_A) &= x_0 M_0 + y_1 m_1 \\ I_1 M_1 + J_0 (m_0 + m_A) &= I_0 M_0 + J_1 m_1 \\ M_0 + m_1 &= M_2 + m_0 \\ x_0 M_0 + y_1 m_1 &= x_2 M_2 + y_0 m_0 \\ I_0 M_0 + J_1 m_1 &= I_2 M_2 + J_0 m_0 \end{aligned}$$

These equations may be readily solved by properly interchanging subscripts in the solution of our three original equations for a simple rectification column. In this manner we obtain the following:

$$\begin{aligned} m_0 + m_A &= \frac{(J_1 - I_1)(x_0 - x_1) + (I_0 - I_1)(x_1 - y_1)}{(J_0 - I_0)(y_0 - y_1) + (J_0 - J_1)(x_0 - y_0)} M_1 \\ m_0 &= \frac{(J_2 - I_2)(x_2 - x_0)(J_1 - J_2)(x_1 - x_0) + (J_2 - I_2)(y_1 - y_0) + (J_2 - J_0)(x_2 - y_2)}{(J_2 - I_2)(y_1 - y_0) + (J_2 - J_0)(x_2 - y_2)} M_0 \\ M_0 &= \frac{(J_1 - I_1)(y_0 - y_1) + (J_0 - J_1)(x_1 - y_1)}{(J_0 - I_0)(y_0 - y_1) + (J_0 - J_1)(x_0 - y_0)} M_1 \end{aligned}$$

whence

$$\begin{aligned} &[(J_2 - I_2)(y_2 - y_0) + (J_2 - J_0)(x_2 - y_2)] \\ &[(J_0 - I_0)(y_0 - y_1) + (J_0 - J_1)(x_0 - y_0)] m_A \\ &= \{[(J_1 - I_1)(x_0 - x_1) + (I_0 - I_1)(x_1 - y_1)] \\ &\quad [(J_2 - I_2)(y_2 - y_0) + (J_2 - J_0)(x_2 - y_2)] \\ &\quad - [(J_1 - I_1)(y_0 - y_1) + (J_0 - J_1)(x_1 - y_1)] \\ &\quad [(J_2 - I_2)(x_2 - x_0) + (I_2 - I_0)(x_2 - y_2)]\} M_1 \end{aligned}$$

In the special case where we are dealing with a mixture for which the total heat I at the boiling point and

also the total heat J at the dew point follow the proportionality law indicated by the equations,

$$J = J_B x + J_A (1 - x)$$

$$I = I_B x + I_A (1 - x)$$

the above equations take the form

$$M_A = \left[\frac{x_0 - x_1}{y_0 - y_1} \cdot \frac{L_B y_1 + L_A (1 - y_1)}{L_B x_0 + L_A (1 - x_0)} - \frac{x_2 - x_0}{y_2 - y_0} \cdot \frac{L_B x_1 + L_A (1 - x_1)}{L_B x_0 + L_A (1 - x_0)} \cdot \frac{L_B y_2 + L_A (1 - y_2)}{L_B x_2 + L_A (1 - x_2)} \right] M_1$$

Now consider the special case where the incoming vapor m_A is a mixture of nitrogen and oxygen, and assume that we obtain pure liquid oxygen at the bottom of the rectification column and pure nitrogen vapor at the top, so that

$$x_2 = y_2 = 1$$

and

$$x_1 = y_1 = 0$$

Substituting these values in the equation just written giving the value of m_A , we obtain

$$m_A = \frac{x_0 - y_0}{y_0 (1 - y_0)} \frac{L_1}{L_2 x_0 + L_1 (1 - x_0)} M_1$$

Now taking $y_0 = 0.21$, $x_0 = 0.47$, we obtain:

$$m_A = \frac{0.26 \times 598}{0.21 \times 0.79 \times 660} M_1 = 1.42 M_1$$

or

$$M_1 = 0.704 M_A$$

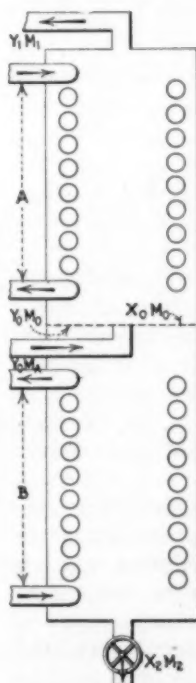
From this result we conclude that if the liquid "reflux" nitrogen M_1 employed at the top of the rectification column is derived from an incoming mixture of air composition, it will be necessary to liquefy as liquid nitrogen about 70 per cent of that mixture in order to obtain complete separation.

The equations we have obtained in this section are very similar in form to those derived for the rectifier with liquid feed at intermediate level and may be utilized in a similar manner to obtain the conditions for minimum reflux.

A similar method may be easily applied to cases where any number of either vapor or liquid feeds are admitted at various levels in the column.

RECTIFIER WITH DISTRIBUTED CONDENSATION AND EVAPORATION

In case the liquid descending in the column is formed by partial liquefaction of the ascending vapors themselves above the point of admission of the incoming vapor m_0 , the above equations are modified. In the figure let A be a liquefying coil distributed throughout the portion of the column above the level of entrance of m_0 and let B be a vaporizing coil distributed in the column below that entrance level. The question as to the distribution of the condensing and vaporizing effects along the rectifier in order that the compositions of



liquid and vapor in contact at all levels shall approach the relation for phase equilibrium we shall consider later in connection with a study of rectification as a reversible process. As before, let M_0 be the total mass of descending liquid at the entrance level of m_A and x_0

its composition. Let m_o be the mass of vapor ascending from below at the same level and y_o its composition, the latter being assumed to be the same as that of the incoming vapor m_A . Let M_i be the mass of mixture leaving the bottom of the column and x_i its composition, while m_i is the mass of the mixture leaving the top of the column and y_i its composition. Then between the five m 's as defined, the four following equations hold:

$$\begin{aligned} m_o + m_A &= m_i + M_o \\ y_o(m_o + m_A) &= y_i m_i + x_o M_o \\ M_o &= m_o + M_i \\ x_o M_o &= y_o m_o + x_i M_i \end{aligned}$$

From these four equations the ratio between any two m 's desired may be obtained.

Eliminating m_i , m_o and M_i from these four equations, we obtain as the relation between m_A and M_o :

$$m_A = \frac{x_o - y_i}{y_o - y_i} \frac{x_i - x_o}{x_i - y_o} M_o$$

which reduces to:

$$m_A = \frac{(x_o - y_i)(x_i - y_o)}{(x_i - y_o)(y_o - y_i)} M_o$$

or

$$M_o = \frac{(x_i - y_o)(y_o - y_i)}{(x_o - y_o)(x_i - y_i)} m_A$$

Inspection of the equation last written shows that, since x_o occurs only in the denominator and $x_o > y_o$, the amount of descending liquid passing the entrance level of the vapor m_A and thus the mass of ascending vapor necessary to be liquefied in the column is least when x_o is as great as possible.

The maximum value of x_o possible to attain at the entrance level of m_A is the composition of that liquid having phase equilibrium with the incoming vapor of composition y_o , since the descending liquid at this point is in contact with that incoming vapor. Hence, if we assume that the compositions at this level are those necessary for phase equilibrium, the value of M_o thus obtained—i.e., the mass of vapor necessary to be liquefied in the column—will be the least possible.

Continuation of this series of articles will be published in a subsequent issue.

Leaching Oxidized Ores by SO_2 Solution

A great deal of work has been done by the Tucson station of the Bureau of Mines on the leaching of copper ores by weak H_2SO_4 solutions, and the process has been determined to be commercially feasible. It is now planned to use this equipment for a series of trial runs on several types of oxidized ores from the Western states—starting on a complex ore from the Miami Copper Co.

Leaching of oxide copper is to approximate plant conditions as closely as possible. Precipitation will be by sponge iron manufactured at the Southwest station. Flotation for the recovery of cement copper will be by both violent agitation and pneumatic agitation type of cell. Re-use of discard solutions will supply all the ferrous sulphate required and the building up of impurities in the mill solution will be studied for possible adverse results. The plan calls for continuous daily plant operation. Several types of ores will be selected and representative samples carefully prepared such that each day of a particular run will have the same ore condition.

Legal Notes

BY WELLINGTON GUSTIN
Of the Chicago Bar

Chemical Use of Palladium Alloy

Court Holds It Was Conceived by F. A. Fahrenwald and His Right to Patent Is Indisputable

In interference proceedings between Charles A. Overmire and one Flynn, junior applicants, and Frank A. Fahrenwald, senior applicant, on applications for an invention for a utensil for chemical use, or a chemical resistant ware formed of an alloy, the Commissioner of Patents decided in favor of the application of Dr. Fahrenwald and his decision was affirmed on appeal to the Court of Appeals of the District of Columbia.

The invention was described in the opinion of the Commissioner of Patents as follows:

"The invention covered by the counts is a device variously denominated 'a utensil for chemical use' (count 1), 'a container for laboratory use' (count 2), 'chemical apparatus' (count 3), or 'chemical resistant ware' (count 4), made of an alloy of gold and palladium in proportions of about 1 of palladium to 5 of gold or silver."

USE OF PALLADIUM: GOLD ALLOY FOR OTHER PURPOSES IS OLD

The court found that the use of an alloy of palladium and gold for dental purposes, points of pencil cases, lancets and for numerous other purposes where strength and elasticity, coupled with the non-tarnishing quality, are required is old in the art. Hence the parties here were held strictly to the thing found to be patentable—that being "a utensil for chemical use."

The issue of the interference was set out in four counts, as follows:

"1. A utensil for chemical use consisting of an alloy of palladium and one or more of the noble metals of lower melting point in homogeneous solid solution, wherein the palladium forms not less than about 20 atomic per cent of the whole.

"2. A container for laboratory use, consisting of an alloy of palladium 10 to 40 per cent and gold 90 to 60 per cent in homogeneous solid solution.

"3. Chemical apparatus having a working surface consisting of an alloy of palladium and one or more of the noble metals, gold or silver, in homogeneous solid solution, wherein the palladium forms between 10 and 40 per cent of the whole.

"4. A heat and chemical resistant ware formed of a metal alloy of approximately 80 per cent gold and 20 per cent palladium."

Dr. Fahrenwald filed his application for patent July 13, 1916, which the court says constituted a constructive reduction to practice. The court found that this date is prior to any date to which Overmire and Flynn could lay claim. The latter, to substantiate their claim of priority, produced testimony to establish a production of a palladium:gold alloy in 1913 for use as a solder. But the court points out that that is not the invention of the issue. There was evidence, also, that prior to Fahrenwald's filing date they had produced a palladium:gold alloy for use as weights; but the court found

that such an alloy was old in 1880. Further they produced evidence to establish that as early as Nov. 25, 1914, they made an anode and a cathode, and these electrodes were successfully tested; but the court found there were publications showing the use of this alloy for electrodes as early as 1911. But, says the court, even if this were not old in the art, electrodes are neither "chemical ware" nor "chemical utensils."

And the Court of Appeals of the District of Columbia was convinced that Overmire and Flynn had "totally failed to prove reduction to practice, or even conception, of the use of the alloy of the issue for 'a utensil for chemical use' prior to Fahrenwald's filing date."

Hence the right to patent was found to be in Fahrenwald. (277 Federal, 618.)

Delay in Shipping Goods

When No Definite Time Is Specified for Delivery Circumstances Determine Reasonableness

Where the date fixed for delivery of goods under contract is important—that is, an essential part of the contract—a delay in the delivery is dangerous. Often such delay may be taken advantage of to refuse acceptance of the goods when laid down, and again the buyer may accept and use the goods and then set up damages caused by the delay as a counterclaim when sued for the purchase price. Again, the circumstances of the delay and the acts of the buyer may excuse the delay, or the buyer may have waived the requirement as to delivery under the contract.

Where no date for delivery has been set by the parties to a sales contract, the law makes delivery within a reasonable time sufficient. What is a reasonable delivery time is a question of fact arising out of the agreement and understanding of the parties at the time of entering into the engagement. Reasonable delivery might be a day or many weeks according to the circumstances of each contract.

In a recent action brought by the Lebanon Valley Iron & Steel Co. against the American Shipbuilding & Dock Corporation to recover the contract price of a quantity of galvanized iron spikes manufactured by the plaintiff for the defendant on the buyer's order, the United States Circuit Court of Appeals has held that a delay in delivering an article to be manufactured does not entitle the buyer to rescind without notice to the seller of such rescission.

BUYER GAVE NO NOTICE OF INTENTION TO RESCIND

In this case the order was given for galvanized spikes and other products of the steel plant. The order contained the following: "Please ship this material at the earliest possible date."

The order was given in September and the spikes were not shipped until the following March, 6 months afterward. Correspondence between the parties 3 months after the order was placed showed that more or less of the material was yet to be delivered, and the court said it implies acquiescence by defendant buyer in such future shipments. Neither then nor afterward, until the spikes were actually shipped, did the buyer give any notice, formal or informal, that they would be refused on account of delay in making delivery. The court further found that although the order called for shipment "at the earliest possible date," the buyer at no time

thereafter requested prompter deliveries than were actually made, gave no intimation that it objected to the delay, but impliedly assented thereto in its letters to the manufacturer and otherwise, allowed the manufacture of the spikes to be completed without protest or notice of any sort, and then, when they arrived, refused acceptance on the ground that plaintiff had broken the contract by failing to ship at an earlier date. Buyer's sole defense for non-payment was the time that elapsed between the order and the delivery.

Under the above-stated facts and circumstances the District Court gave judgment for the buyer against the manufacturer and seller, but the Court of Appeals reversed the judgment and awarded a new trial to the seller. It says buyer's defense cannot be sustained under these facts. The contract in question fixed no definite date for performance. It says the buyer understood that the articles ordered were to be made by the seller and therefore could not have expected immediate delivery. A substantial period of time, sufficient for the manufacture, was necessary in contemplation. Moreover, under conditions then prevailing and of which the buyer was fully aware, delays in filling such orders were often unavoidable and always to be taken into account. This being so, the higher court says that buyer "could not remain silent, accept partial deliveries 3 and 4 months after the order was given, make no objection to further delay in shipping the balance of the order, seemingly acquiesce in what plaintiff was doing, and then upon tender of the spikes, barely 6 weeks later, refuse to receive them for no other reason than the lapse of time since they were ordered."

THE LAW DEFINED

The settled rule of law is that when the contract fixes no definite date for performance, notice of the intention to rescind the contract is a prerequisite to the right to rescind. And the right to rescind because of delay must be asserted promptly.

The rule is stated in volume 6, "Ruling Case Law," page 932, as follows: "The failure of a party to perform his part of a contract does not *per se* rescind it; the other party must within a reasonable time give notice of his intention to rescind. A formal or written notice is not necessary, but the law requires, on the part of him who would rescind, some positive act which shows such an intention."

And it is laid down in 9 Cyc., 613: "When no time has been fixed for the performance of a contract, either party may limit a reasonable period within which it must be performed by giving the other party a reasonable notice."

In the case as set out above the court says the fact that the goods were to be manufactured, to say nothing of the conditions then existing in the industry, made shipment "at the earliest possible date" a plainly indefinite, if not uncertain, time. The mere lapse of time did not serve to relieve the buyer from obligation, and the indefinite date for delivery did serve to put upon him the duty of giving reasonable notice of its intention to rescind the order. Its continued silence carried the implication of assent to the delay.

As to whether delivery was made within a reasonable time the court said the difficulties attending the manufacture of the spikes and their delivery at that particular time were proper and necessary as bearing directly on the question of reasonable time. So 6 months' delay was not unreasonable time for delivery in this case.

Electric Enamel Furnace Lowers Rejections on Stove Parts

Cast Iron and Sheet Steel Enameled in Electric Furnace Operating on Schedule Which Insures Minimum Power Rate

AN installation of heating equipment that is interesting both as a new application of the electrically heated vitreous enamel furnace and because of some of the factors connected with its operation has recently been made by the Galusha Stove Co., of Rochester, N. Y., maker of high-grade enameled gas and combination ranges. The furnace is used for two classes of work, that of baking vitreous enamel on cast-iron stove parts, and on sheet steel. It operates at from 1,200 to 1,400 deg. F., with a maximum temperature range of 2,000 deg. F., and has a connected load of 118 kw. at 230 volts, three phase, sixty cycles. Its capacity is normally estimated at approximately 7 lb. of metal per kw.-hr.

FURNACE CONSTRUCTION INSURES UNIFORM HEAT DISTRIBUTION

The equipment consists of the furnace proper and the automatic control panel and instrument. The furnace is constructed of brick, with a refractory lining, having a sliding door that gives access to the upper compartment from the front. The dimensions of the overall working space are 5 ft. deep by 3½ ft. wide by 23 in. high. The interior is divided horizontally into two compartments by narrow shelves on each side wall, which support the sides of the tray on which the work to be baked is set. The nickel-chromium heat units are mounted away from the side walls and are about evenly distributed between the upper and lower compartments. This arrangement, together with the curved roof, causes the heat to strike the charge from all directions, and makes for a very uniform heat distribution throughout the furnace interior. The temperature is automatically controlled by a Leeds & Northrup temperature control instrument and an automatic control panel carrying contactors and overload relays. The heating elements and the control panel are of General Electric Co. manufacture.

The two classes of material require for their baking two temperature settings and durations of baking. The cast-iron stove parts are baked for 9 minutes at a tem-

perature of 1,250 deg. F. and the sheet steel for 4 minutes at 1,400 deg. F. The company operating the furnace buys power from the central station on what is known as a three-rate schedule, whereby power used at a steady demand for 24 hours a day earns the lowest power rate. A schedule has been worked out for the operation of the furnace so that its running periods are dovetailed with those of the other power-using devices in the foundry of the plant, with the result that no additional demand is created during the daytime. By this method the operating expenses of the furnace itself are held to a very low level. Also, by not running the furnace in peak hours through the winter months, further economy has been effected in the operating cost. The overall economy that has resulted from the use of the furnace is due, in addition to the factors already mentioned, to the speed with which the material is finished, the reduced attendance necessary, and, most important, to the perfection of the finished product.

PERCENTAGE OF REJECTS SMALL

In regard to the latter item, the percentage of rejects from the electric furnace is only about 4 per cent by weight of all the material baked. This percentage is remarkable in this special case, because a large portion of the work baked is enameled in white or light gray, colors that are very susceptible to spoilage from a contaminated atmosphere, either in the furnace itself or in the neighborhood. It has been possible, in the case of this factory, to save both space and time by installing the spraying equipment in the same room with the furnace and to assemble the sprayed parts on trucks in close proximity to the furnace, where they are left until their turn comes. Furthermore, the furnace has been operated by men who previously had little or no experience, either with electric furnaces or with enameling itself.

Present Situation in Rubber Sundries Trade

In a paper entitled "A Bigger and Better Sundries Trade," given by Fordyce Jones in Manchester recently, it was stated that the rubber industry at present might be described as being at the crossroads. In order that it might advance, it was essential to create demand and, through salesmanship and systematic advertising, to increase sales. Although the industry was originally founded in England, British rubber sundries are inferior to those of other countries in many instances. British manufacturers have acquired the reputation of regarding innovation with disfavor and of possessing very little knowledge of the development of the industry in other countries. Moreover, very few inventions were really taken up by the public and frequently the dealers who attempted to sell them were heavy losers. The consequent fear of failure was in reality the chief deterrent to the advancement of the industry in Great Britain.

As an example of the differences existing between British and American rubber sundries, surgeons' gloves were discussed. For this purpose, hard rubber is essential and must not be overmilled. It is important also to use a solvent free from residue. To be sure, solvent is very much cheaper in America, where, moreover, there is no amateur dipping or curing. Every operation is mechanical there and the glove is never touched; the cure is by vapor. In many respects, therefore, Great Britain could learn considerable from America concerning the rubber sundries trade.



ELECTRICALLY HEATED ENAMEL FURNACE

Synopsis of Recent Chemical & Metallurgical Literature

Character and Uses of Peat

A very fine bulletin has just been issued by the U. S. Geological Survey describing the peat industry of the United States and its opportunities. This is Bulletin 728, entitled "The Occurrence and Uses of Peat in the United States," by E. K. Soper and C. C. Osbon.

In this bulletin are summarized very completely the chemical and physical properties of peat deposits, including those of commercial importance and others that at present offer no promise of economic development. The application of peat in fertilizers, as a filler in feeding stuffs and as a fuel for local use in territory where coal is scarce or very high will justify careful consideration of the bulletin by anyone interested in this business. It may be obtained on application from the U. S. Geological Survey, Washington, D. C.

Thomas and Petree Process of Sugar Clarification in Hawaii

A discussion of a sugar process by S. S. Peck deserves respectful consideration and therefore the January number of the *International Sugar Journal* received unusually careful attention. The application of Dorr thickeners to sugar clarification by means of the Thomas and Petree process has been carried out in over forty plants in various parts of the world, but never before has there been an installation in Hawaii. The process involves a different routing of juice from the mills and a strategic insertion of two thickeners. The limed juice from the first mill passes through a preheater and thickener and goes immediately to the evaporators. Along with this there goes the clarified juice from the second mill. The strained juice from the second mill is limed separately and the mud from the first juice thickener is added to it. This mixture is preheated and clarified, the juice as indicated then going in with first mill juice and the mud is returned and added to the third mill juice, which in turn is returned to the first mill.

Thus it will be seen that there are three closed cycles, the mud finally going to waste (or fuel) with bagasse and the plant delivering one grade of clear liquor to the evaporators.

The advantages are many and will be briefly listed.

1. Character of the mud. The process calls for a slightly alkaline settling

Important Articles in Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. Those that are of unusual interest will be published later in abstract in this department; but since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

THOMAS AND PETREE PROCESS IN HAWAII. S. S. Peck. *Internat. Eng. Jour.*, January, 1923, p. 12.

LOW-TEMPERATURE COKING BY THE MOSCICKI PROCESS. R. Moritz. *Chim. et Ind.*, December, 1922, pp. 1172-1174.

SEWAGE DISPOSAL. Leonce Fabre. *Chim. et Ind.*, December, 1922, pp. 1180-1200.

TOP SIZING WITH RUBBER LATEX AND CASEIN. *India Rub. World*, Feb. 1, 1923, pp. 283-289.

CHEMICAL ASPECTS OF AGRICULTURE. E. Holmes. *Chem. Age* (London), Jan. 27, 1923, pp. 80-83.

THE PROBLEM OF DUST EXPLOSIONS IN INDUSTRY. W. E. Gibbs. *Chem. Age* (London), Jan. 20, 1923, and Jan. 27, 1923.

FACTORS INFLUENCING THE YIELD OF AMMONIA IN THE CARBONIZATION OF COAL: Part II. Dissociation, the Influence of Water Vapor and the Character of Contact Materials. R. A. Mott and H. S. Hodsman. *J. Soc. Chem. Ind.*, Jan. 5, 1923, pp. 4-12.

SELECTIVE HYDROGENATION. Thomas Percy Hilditch and Charles Watson Moore. *J. Soc. Chem. Ind.*, Jan. 12, 1923, pp. 15-17.

CATALYTIC HYDROGENATION WITH NICKEL. Factors Determining Catalytic Activity. R. Thomas. *J. Soc. Chem. Ind.*, Jan. 19, 1923, pp. 21-26.

EXPLOSIONS IN LIQUID AIR RECTIFICATION PLANT. Ernest Fyfe. *J. Soc. Chem. Ind.*, Jan. 26, 1923, pp. 37-39.

THE LESSER-USED DRYING OILS: POPPY-SEED OIL. Glenn H. Pickard. *American Paint J.*, Feb. 12, 1923, pp. 18-22.

PROMOTING HEALTH IN INDUSTRY. III—Industrial Dusts and Poison Hazards. C. E. A. Winslow. *Iron Trade Review*, Feb. 8, 1923, pp. 440-1.

first and then an acid clarification at a somewhat higher temperature. This produces what is described as a stabilized mud which is more firmly fixed by the bagasse with a consequent diminution in the solution of insolubles.

2. Clarification of the juices. The juice from the first mill settles much better. Thus the Thomas and Petree process make use of this fact in returning the first mill mud to the second mill juice to aid in its clarification. This is a distinct improvement and in settling the first mill juice the Dorr equipment reduces the per cent of suspended matter and a more brilliant juice is obtained.

3. Automatic liming equipment.

4. Diminution in the percentage of juice in the mud from 10 to 25 per cent to 5 per cent.

5. The return of the mud to the rolls produces no ill effects on them due to the continuous nature of the process. Other attempts to add mud to the cane have been unsuccessful because of the unevenness of the addition and to the different character of the mud.

6. No definite data on extraction were available, but calculations indicated the return of 5 per cent juice to the second mill would result in a slight drop in extraction. An actual increase is mentioned in some instances by the inventors.

7. Effect on boiling. Clearer juices should make for less evaporation troubles.

8. Effect on fuel. Unexpectedly the clinker in the furnaces disappeared with the return of the mud.

In addition to the already enumerated items the undetermined losses will be fewer; some fuel will be saved, because of the elimination of the water used in sweetening of the cake; considerable labor will be saved, including all of the press men and some of the settling tank force. Finally, there will be a saving of material such as filter press parts, mud pumps and cars, etc.

A DISADVANTAGE WHICH MAY DEVELOP

This has to do with the value of the filter press cake as fertilizer. Although data on this point are a little confusing, there seems to be no doubt that the press cake has distinct fertilizer value, and an estimate of the economic value of the material should be subtracted from the financial gains which the process can show.

The financial advantage of an installation has been carefully estimated for a plant of assumed capacity and operating methods. The specifications are given in full in the article; there is need, however, only for a summary here. The plant grinding 200,000 tons of cane and producing 25,000 tons of sugar should make a total saving of \$41,478. If we subtract from this the interest on the investment in the Dorr equipment, the value of press cake as a fertilizer, etc., we should have a net gain of \$23,428, or 39 per cent on the investment over and above the normal interest rate.

An Interesting Note on Propyl Alcohol

The *Pharmazeutische Zentralheften* (No. 31, 1922) declares that propyl alcohol is of unusual merit as a disinfectant to be used on the skin. It is said to be at once a strong germicide and harmless to the skin and is used in solutions of from 35 to 50 per cent strength with good results on facial acne and disorders of the scalp. Poultices containing 10 to 20 per cent solutions are said to have been successful in treating bacterial eczema.

Recent Chemical & Metallurgical Patents

American Patents Issued Feb. 6, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.*'s staff and those which, in

our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,443,983—Process for Obtaining Paraffine and Highly Viscous Lubricating Oils From Bituminous Masses. Ernst Erdmann, Halle-on-the-Saale, Germany.

1,444,051—Fire-Resisting Composition. Charles Ridgely Allison, Peekskill, N. Y.

1,444,068—Process of Manufacturing Anthraquinone and Phthalic Anhydride. Harry D. Gibbs, Pennsgrove, N. J., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.

1,444,129—Method of Converting Hydrocarbon Oils. William F. Muehl, Kansas City, Mo.

1,444,160—Method for the Precipitation of Iron in Aluminous Solutions. Thor Mejdell, Skolen, near Christiania, Norway, assignor to Aktieselskabet Labrador, Christiania, Norway.

1,444,162—Ceramic Bonded Carbide Article and Method of Making Same. Milton F. Beecher and MacDonald C. Boeze, Worcester, Mass., assignors to Norton Co., Worcester, Mass.

1,444,178—Method for Commercially Obtaining Water-Soluble Milk Albumen and Milk Sugar. Adolph D. Fest, Chicago, Ill.

1,444,208—Process of Fractionation. Harry F. Perkins, Pittsburgh, Pa., assignor to Rosanoff Process Co., Pittsburgh, Pa.

1,444,250—Preparation of Active Animal Amylase and Process of Making Same. Richard Kern and Georges Jenny, Basel, Switzerland, assignors to Swiss Ferment Co., Ltd., Basel, Switzerland.

1,444,255—Method of Producing Cyanamide. Johan Hjalmar Lidholm, Warog, Sweden.

1,444,257—Process of Producing Colloidal Soluble Substances and Suspensions. Leon Lillienfeld, Podhajce, Poland.

Complete specifications of any United States patent may be obtained by remit-

1,444,276—Manufacture of Wine-Yeast Preparation. Friederich Sauer, Gotha, Germany.

1,444,277—Manufacture of Dyestuffs. Maximilian P. Schmidt and Heinrich Roese, Biebrich-on-the-Rhine, Germany, assignors to Kalle & Co., Germany.

1,444,309—Manufacture of Cement Mixtures. Fabio Ferrari, Rome, Italy, assignor to the Company Bombrina Parodi-Delfino, Rome, Italy.

1,444,331—Cellulose-Ether Composition. Stewart J. Carroll, Rochester, N. Y., assignor to Eastman Kodak Co., Rochester, N. Y.

1,443,333—Nitrocellulose Composition. Hans T. Clarke, Rochester, N. Y., assignor to Eastman Kodak Co., Rochester, N. Y.

1,444,406—Cellulose-Ether Composition. William R. Webb, Rochester, N. Y., assignor to Eastman Kodak Co., Rochester, N. Y.

1,444,421—Process and Apparatus for Burning Powdered Coal. Alonzo G. Kinyon, Chicago, Ill., assignor to Fuller Engineering Co., Allentown, Pa.

1,444,484—Metallurgical Process for Treatment of Zinc Compounds. Earl P. Stevenson, Cambridge, Mass., assignor to Arthur D. Little, Inc., Cambridge, Mass.

1,444,527—Furnace Refractory. Charles A. Scharschu, Pittsfield, Mass., assignor to General Electric Co.

1,444,548—Process of Manufacturing Leather From Intestines. Eugene Markus, Budapest, Hungary.

1,444,594—Process of Impregnating Plant Tissues With Ammonium Nitrate for Explosive Purposes. William M. Dehn, Seattle, Wash.

1,444,623—Method of Producing Carbonates of the Alkaline Earth Metals. James H. MacMahon, Saltville, Va., assignor to the Mathieson Alkali Works, Inc.

ting 10c. to the Commissioner of Patents, Washington, D. C.

Chlorinating Hydrocarbons—In the direct chlorination of organic compounds, by the use of a catalyst, such as activated carbon, it has been found that certain undesirable chlorinated compounds with a boiling point higher than that of the compound which it is desired to make are formed during the early stages of the reaction, and these compounds are believed to impede the action of the catalyst by condensing on it in liquid phase. Herbert H. Dow has patented a procedure to overcome this difficulty, the patent being assigned to the Dow Chemical Co., Midland, Mich. In a specific illustration of the improved process the patentee describes the chlorination of the acetylene. Upon bringing chlorine in contact with acetylene in the presence of a porous catalyst, such as activated carbon, a number of substitutions or addition compounds are formed, the most con-

spicuous as well as the most desirable being the tetrachloride. The formation of these compounds begins at a temperature as low as from 40 to 50 deg. C., whereas the boiling point of such compounds ranges from approximately 60 to 200 deg. C., and upward, the boiling point of acetylene tetrachloride, for example, being approximately 140 deg. C. As a result of the initial reaction taking place in this process of chlorination, compounds may be formed which will not be in the vaporous state at the temperature at which the reaction occurs, and even though the temperature may be raised quite frequently they may still continue present in the carbon or other catalyst to such an extent as to affect its activity materially. When the activity of the catalyst has been reduced to a certain point, the flow of the reacting substance is shut off and the reaction chamber is placed under a

vacuum so that the high-boiling compounds are vaporized. After such evaporation the reaction is resumed under the former conditions. The undesirable products are, of course, withdrawn in the vaporous condition and may be condensed and separated by fractional distillation or by chemical means. (1,437,636. Dec. 5, 1922.)

Rubber Vulcanization—S. M. Caldwell of Leonia, N. J., has assigned this patent to the Naugatuck Chemical Co., together with patents 1,440,962 and 1,440,963. All of these patents have to do with the vulcanization of rubber and the product obtained thereby. They are continuation of a number of serials filed previously. In the three patents there are a total of 150 claims, and all of them deal with the use of various types of vulcanizing agents, starting with compounds like zinc ethylxanthogenate. Various metal salts, such as zinc, mercury, lead, copper, etc., are used and organic compounds having a general structural formula represented by

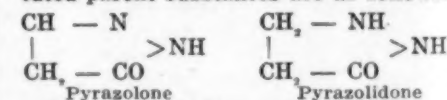
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They are divided into three general groups, the first group being the metal thiol salts, the second group being bisulphides, and the third group being monosulphides. It will hardly pay to go into this elaborate patent more thoroughly, for it seems to be basic for a wide variety of products belonging to this group. (1,440,961. Jan. 2, 1923.)

Smokeless Powder—Tenney L. Davis, of Somerville, Mass., has patented the use of certain nitrogen compounds of the type known as heterocyclic for gelatinizing agents for the manufacture of smokeless powder. Specifically mentioned among such substances are the substituted pyrazolones and pyrazolidones. The formulas of the unsubstituted parent substances are as follows:



Phenyldimethylpyrazolone, which is extensively used in medicine under the name of antipyrine, is also claimed to be excellent for the purpose. The advantages claimed for this invention reside in the fact that powders coated with the substance will be less hygroscopic than ordinary smokeless powder and will show a greater degree of progressive burning, giving higher velocity to the projectile while producing lower gas pressures in the barrel of the gun. (1,439,505. Dec. 19, 1922.)

Cellulose-Ether Solvent—Samuel E. Sheppard, of Rochester, N. Y., has taken out a patent covering the use of a solvent mixture for use in the plastic arts such as sheet or film and varnish manufacture. The feature of the patent is the employment of hydrogenation productions of the hydrocarbons and homologs. The hydrogenated substances are individual solvents of the cellulose ethers, but they may also be

employed in conjunction with other compounds, such as chloroform, ethyl alcohol, etc. Typical examples of the compounds used are tetrahydronaphthalene, or tetraline, and dekahydronaphthalene, or dekaline. These are high-boiling solvents and consequently can only be used in film dope in a mixture with other low boilers. A typical formula is given as 100 to 200 parts cellulose ether in a mixture containing 600 to 900 parts of chloroform, 300 to 450 parts ethyl alcohol, and 15 to 30 parts dekaline or tetraline, or mixture thereof. (1,441,181. Jan. 2, 1923.)

British Patents

For complete specifications of any British patent apply to the Superintendent British Patent Office, Southampton Buildings, Chancery Lane, London, England.

Briquet Fuel—A composition fuel which is molded into block form is made up of 10 parts by weight of asphalt or pitch, 800 parts of fuel oil, 25 parts of shale and 45 parts of coal or coke, with or without 160 parts of tar, and 20 parts of peat impregnated with fuel oil. The shale and coal are finely ground and stirred in a mixing vessel into which steam is injected. Finely divided peat impregnated with oil may be added. The asphalt, and sometimes tar, and fuel oil are heated in a separate vessel and the mixture when liquid is combined with the shale, etc., the incorporated mass being molded on cooling. (Br. Pat. 187,351. H. J. Franklin, London, and J. Pettingall, Chinford, Essex. Dec. 13, 1922.)

Bottle Capping Solution—A composition particularly adapted for sealing bottles consists of an agglutinant such as glue or silicate of soda, an earthy filling material such as talc, and an aqueous solution of soap and wax. A capsuling mass consists of 10 parts of leather glue diluted to 28 to 35 deg. Bé. mixed with 20 parts of talc and 3 parts of a solution containing 25 grams of hard soap and 40 to 50 grams of carnauba wax per liter. Coloring matter may be added. (Br. Pat. 187,611; not yet accepted. H. H. Warmund, Berlin. Dec. 13, 1922.)

Hydrogen Peroxide—Hydrogen peroxide of more than 10 per cent strength is obtained in one operation by treating an alkali perborate or a suspension in water of an alkali perborate with a mineral acid, such as sulphuric, hydrochloric or phosphoric acid, with agitation. Boric acid and the salt produced, such as sodium sulphate, separate. The perborate may be added to the concentrated acid, or the acid to a suspension of the perborate. (Br. Pat. 186,871. Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler and O. Liebknecht, Frankfurt-on-Main. Nov. 29, 1922.)

Methane—Methane is produced by passing a mixture of water vapor with carbon monoxide or a gas, such as water-gas, containing carbon monoxide over two nickel contacts or sets of contacts in series, the water vapor being

removed from the mixture between the two contacts. After elimination of carbon dioxide, the product consists of pure methane or methane admixed with a little hydrogen. For the second contact, nickel obtained from calcined nickel nitrate and maintained at a temperature of 350 to 400 deg. C. may be used; preferably, however, the nickel is prepared from nickel carbonate or organic nickel compounds and is employed at a temperature of about 300 deg. C.

In a second specification by the same patentee, the process described in the parent specification for the production of methane from carbon monoxide and hydrogen is modified by introducing carbon dioxide into the gas mixture either before the reaction starts or before it is completed. The theoretical proportions of carbon monoxide and hydrogen, namely 1:3, may then be employed. According to the examples, (1) a mixture of carbon dioxide, carbon monoxide, hydrogen and nitrogen is passed over heated nickel, prepared by reducing precipitated nickel carbonate; water is then eliminated and the resulting gases are passed over a second nickel contact; after removal of water and carbon dioxide, the product consists of methane and nitrogen; (2) ordinary illuminating gas, completely desulphurized and freed from cyclic hydrocarbons, is mixed with a little carbon dioxide and circulated over reduced nickel with periodic separation of the water formed; the gas is then conducted over a further nickel contact and after cooling, the carbon dioxide is removed; a mixture of methane and nitrogen remains. Specifications 146,114 and 161,924 are referred to. (Br. Pat. 186,899. Farbwerke vorm. Meister Lucius und Brüning, Hoechst-on-Main. Nov. 29, 1922.)

Plastic Compositions—Four compositions containing peat are described for the manufacture of bricks, building blocks, etc.; (1) 70 parts by volume of peat, 25 parts of lime, 5 parts of sulphate of zinc; (2) 75 parts of peat, 20 parts of lime, 1 part of alum, 2 parts of tar, 2 parts of gypsum or silicate of soda; (3) 45 to 50 parts of peat, 45 parts of clay, 5 to 10 parts of silicate of soda; (4) 30 to 35 parts of peat, 60 parts of clay, 5 to 10 parts of silicate of soda. The peat as it comes from the bog is macerated, the other ingredients are added, and articles are molded. In the case of compositions 1 and 2, articles harden without artificial heat, other articles are burned. Reinforcements may be inserted during molding. (Br. Pat. 186,355. C. L. Hamon, Ballycumber. Nov. 22, 1922.)

Tungsten—In a process for the manufacture of tungsten suitable for electric lamp filaments, there is added to the tungsten compound before its reduction to metal a combination of two substances, one of which will introduce into the resulting metal an oxide irreducible by hydrogen, such as thorium or silica, and the other an alkali metal compound. For example, there may be left in the tungstic acid before its reduction 0.5 to

1 per cent of thorium and 0.03 to 0.3 per cent of sodium chloride, or 0.05 to 0.5 per cent of caesium chloride, the subsequent reduction, pressing, sintering, swaging and drawing being carried out in the usual manner. Specification 155,851 is referred to. (Br. Pat. 186,497. General Electric Co., Ltd., and C. J. Smithells, London. Nov. 22, 1922.)

Dyes—Triarylmethane dyes containing a thiazole ring are prepared by condensing tetramethyldiaminobenzhydrol or equivalent tetra-alkyldiaminobenzhydrol (in which one or two alkyl groups may be replaced by benzyl groups) with an arylbenzthiazole and oxidizing the resulting leuco compound. According to examples, tetramethyldiaminobenzhydrol is condensed with 1-phenyl-5-methylbenzthiazole, 4'-methoxy-1-phenyl-5-methylbenzthiazole, or dehydrothiotoluidine, and the leuco bases oxidized; the leuco base from dehydrothiotoluidine may be acetylated, or, according to the provisional specification, it may be alkylated or treated with phosgene. The products dye wool or tannin-mordanted cotton and also unmordanted cotton or paper, bright green shades.

1-Phenyl-5-methylbenzthiazole is prepared by heating benzyl-p-toluidine with sulphur.

4'-Methoxy-1-phenyl-5-methylbenzthiazole is prepared by methylating 4'-oxy-1-phenyl-5-methylbenzthiazole with methyltoluene sulphonate. (Br. Pat. 186,517. J. Braddley, E. H. Rodd and H. H. Stocks, assignors to British Dyestuffs Corporation, Ltd. Nov. 22, 1922.)

Nickel—Nickel is deposited from nickel carbonyl by passing the gases containing the nickel carbonyl between a number of parallel heated surfaces arranged close together, say from $\frac{1}{2}$ to 1 in. apart. Two forms of apparatus are described in the two specifications. (Br. Pat. 186,457 and 186,458. H. E. Fierz, Zurich. Nov. 22, 1922.)

Fatty Acids—Waste cellulosic materials such as wood waste are hydrolyzed to impure sugary worts, which, after purification, are subjected to symbiotic bacterial fermentation to produce fatty acids, mainly butyric acid. The hydrolysis of the disintegrated wood waste is effected by means of dilute sulphuric acid and superheated steam; the acid liquors are then neutralized with lime or chalk, the sugar solution extracted from the product by exhaustion, and purified from gums, resins, mucilages, etc., by adding excess of milk of lime, followed if necessary by passage of the decanted solution through animal charcoal. The purified wood wort is then treated with the ferments obtained by inoculating sugar solutions containing mineral salts with bacilli of the intestinal digestion of herbivora or contained in garden earth; by this means, all the reducible sugars of the wood wort are converted into acids—viz., butyric, acetic, propionic, valeric and caproic acids. The fermented wort is concentrated to a sirup preferably *in vacuo* and treated in a

still with sulphuric or hydrochloric acid or preferably sodium bisulphate to liberate the free organic acids which distill off and are fractionally separated. The carbon dioxide of the fermentation is recovered by absorption in sodium carbonate, from which it is freed by boiling. (Br. Pat. 186,572. Lefranc et Cie., Paris. Nov. 22, 1922.)

Desulphurizing Petroleum—In desulphurizing petroleum or petroleum distillates in the liquid state by adsorptive treatment with a dehydrated natural or artificial inorganic gel, the desulphurizing agent is used when freshly ignited and while still warm. Varieties of fullers earth such as floridin, or bauxite, or metallic hydroxides of a colloidal character, such as iron and aluminum hydroxides, may be used. The oil is mixed with the adsorptive substance or filtered through it. Means such as a steam-jacket may be provided to maintain the oil and adsorptive substance warm during contact. In treating benzine, 4 lb. of floridin or 9 lb. of bauxite per gallon is used. (Br. Pat. 186,955. A. E. Dunstan and F. B. Thole, Sunbury-on-Thames. Dec. 6, 1922.)

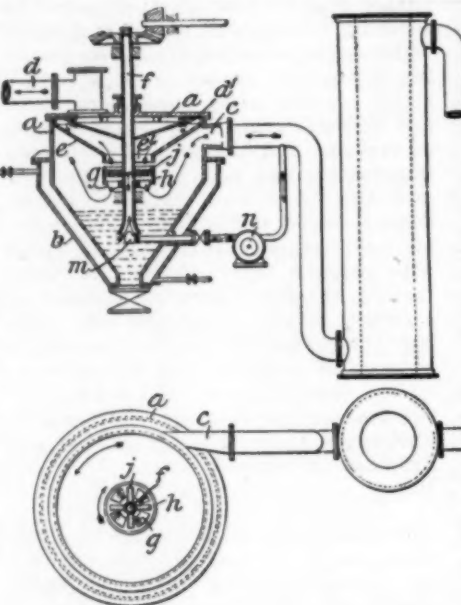
Soap—The lime sludge obtained by the action of soda on a lime soap is treated to remove residual soap by adding soaps of palm kernel oil, copranut oil or resin. The sludge is then lixiviated with water or weak salt solution and the lime carbonate filtered from the soapy solution. Palm kernel oil soap or copranut oil soap is added in such quantities as to amount to not less than 25 per cent of the total soap in the sludge after the addition, and resin soap to a corresponding minimum amount of 20 per cent. If the residual soap is wholly or mainly palm kernel oil soap or copranut oil soap, this addition is unnecessary. (Br. Pat. 186,960. P. Krebitz, Munich. Dec. 6, 1922.)

Iron Alloys—Workable low-carbon iron alloys containing chromium in smaller proportion than iron are made by blowing in a converter molten metal containing carbon, intentional overblowing being avoided. The charge to be blown may consist of ferrochromium diluted with pig iron, scrap steel, or other form of iron; or high-carbon iron may be mixed with low-carbon ferrochromium or high-carbon ferrochromium may be mixed with low-carbon iron; or both materials may contain carbon. Silicon is preferably present in or added to the charge in sufficient proportion to raise the temperature by oxidation during the blowing. The finished alloy is deoxidized by means of manganese or other deoxidizer. (Br. Pat. 186,982. J. C. Gillot, Sheffield. Dec. 6, 1922.)

Explosives—Mixtures of lead azide and lead trinitroresorcinate for use as explosive priming compositions are prepared by the simultaneous precipitation of the two salts or by the precipitation of one salt from a solution containing the other salt in suspension.

For example, lead azide is precipitated by the addition of sodium azide to a solution of acetate of lead containing lead trinitroresorcinate in suspension. (Br. Pat. 187,012. E. von Herz, Berlin. Dec. 6, 1922.)

Treating Gases—Relates to the treatment of gases or vapors with a liquid medium, which may contain catalytic or other solids in a mechanical or colloidal state in suspension therein, in centrifugal or cyclonic apparatus in order to cause the liquid or the suspended solid to absorb one or more constituents of the gases or else to promote a reaction between the gases and the liquid or the solid. The process may be employed for the simultaneous desulphurization and hydrogenation and oxidation of gases or oil vapors by means of catalysts and oxidizing agents in the presence of ammonia, which may be supplied by means of producer gas.



The centrifugal or cyclonic apparatus may be so constructed that the reaction may take place at a pressure above or below atmospheric.

In the preferred apparatus the gas or gases to be treated enter the treating vessel *a* tangentially and at great speed through an inlet *c*, the liquid containing the desired solid being kept at the desired temperature by means of a heating or cooling jacket *b*. The gas travels spirally around the inner surface of the chamber *a* and is forced by incoming gas downward toward the center of the apparatus, where it is forced by rapidly rotating propellers *g* vertically upward through a rotating basket or mixing chamber *h* carried by a central tube *f*, the gas being eventually forced through openings *e*, *d* in baffle plates to the outlet *d*. While in the vessel *a* and during its passage through the basket *h*, the gas is mixed intimately with a portion of the liquid and contained solid which is forced up the center tube *f* by an injector *m* supplied with a portion of the gas by a compressor *n*, the liquid being dis-

charged into the basket through radial pipes *j* and sprayed through perforations in the basket across the vessel *a*. Fresh liquid may be fed into the apparatus and spent liquid discharged continuously during the operation.

Any desired number of baskets may be mounted on the tube *f*, and two or more complete apparatus may be arranged in series or in parallel, the gases or vapors receiving the same or different treatment in each. The basket is preferably rotated in the direction opposite to that of the incoming gases, but where two or more baskets are employed in the same or different apparatus, they may be arranged to rotate in opposite directions. (Br. Pat. 186,945. J. F. Ward and H. Nielsen, London. Dec. 6, 1922.)

Lubricants, Cosmetics and Leather Dressing—Wax or crude bitumen, such as ozokerite, beeswax, montan wax, carnauba wax or Japan wax, is treated with an aldehyde, such as formaldehyde or furfural, in presence of an alkali, with or without addition of a ketone, such as acetone or methyl ethyl ketone, or a divalent or trivalent alcohol, such as glycerol or glycol. The product, after removal of the alkali by washing, may be added to mineral, tar, animal or vegetable oil, yielding viscous or paste-like products, which may be used as lubricants or cosmetics, or emulsified with water, forming salves or leather-dressing compositions. It may be mixed with 20 to 30 per cent of paraffine wax, ceresin, ozokerite or the like without affecting its properties. Instead of aldehydes, their polymerization products or substances, such as hexamethylene tetramine, capable of liberating aldehyde may be used. (Br. Pat. 186,950. Plauson's, Ltd., London. Dec. 6, 1922.)

Sulphuric Acid—The process described in the parent specification is modified as follows in order to obtain an acid of higher concentration. In one modification a solution of nitrosylsulphuric acid of above 58 deg. Bé. is supplied to each unit of the plant, a more elevated temperature being employed if necessary. In a second method, the central part of the plant is irrigated with a solution of nitrosylsulphuric acid of a lower concentration than that used in the fore and rear parts of the plant. The second method may be further modified by adding water to the units in the middle of the plant, the nitrogen oxides consequently liberated being recovered by subsequently irrigating with acid of the same concentration as that employed in the fore part of the plant. (Br. Pat. 187,016. T. Schmiedel, Nurnberg, and H. Klencke, Frankfurt-on-Main. Dec. 6, 1922.)

Turpentine Substitute—An oil, having the properties of oil of turpentine, is obtained by heating rubber waste to about 220 deg. C., condensing the vapors given off, and rectifying this liquid by distillation, preferably with steam. (Br. Pat. 188,008. C. Lefebvre, Seine, France. Dec. 29, 1922.)

Technical News of the Week

Current Events in the Chemical, Metallurgical and Allied Industrial Fields
Legislative Developments—Activities of Government Bureaus, Technical Societies and Trade Associations

Tentative Program Arranged for A.C.S. Spring Meeting

Important Papers Announced by Divisions and Sections
—Membership of Local Committees

THE spring meeting of the American Chemical Society will be held with the New Haven and Connecticut Valley sections, at New Haven, Monday, April 2, to Saturday, April 7, inclusive. All divisions and sections are planning extensive meetings with the exceptions of the divisions of Fertilizer Chemistry and Leather Chemistry. The local committees have nearly completed their arrangements and an interesting program, together with instructive excursions, is assured.

The dedication of the Sterling Chemistry Laboratory of Yale University will be held on Wednesday, April 4, and all members of the society are invited to attend the ceremonies and to inspect the splendid new building.

Divisional Programs

All divisions and sections, as enumerated below, will meet. All divisions and sections will have two full days at their disposal if needed.

Before the general meeting of the Division of Industrial and Engineering Chemistry there will be presented papers by men of national reputation dealing with various phases of industrial chemistry. A whole day will be devoted to a symposium on "Materials of Chemical Equipment Construction." Subject matter will include cement, galvanized coatings, paints, rubber, glass, enamels, stoneware, wood, iron alloys, synthetic resins, laboratory construction, lead, etc. Philip A. Singer is chairman of the symposium.

The Water, Sewage and Sanitation Division announces no special features, but enough titles of papers have been received to insure a good program for that Division.

The Agricultural and Food Chemistry Division will discuss general papers and especially those on jams, jellies, pectin, etc., the first day of the meeting, and the second day will be given over to a symposium on "Insecticides and Fungicides." This symposium will be in charge of F. C. Cook, Bureau of Chemistry, Washington, D. C.

The Division of Cellulose Chemistry is planning a symposium on the subject of "Oxycellulose, Cellulose Hydrate and Hydrocellulose."

The Division of Chemistry of Medic-

inal Products is planning an interesting meeting. Applicable papers in the related fields of organic chemistry and biology are particularly requested.

The Division of Organic Chemistry is planning a symposium on "Catalysis."

The Division of Dye Chemistry considers this an opportune time to describe and record the accomplishments and the trials of the American dye industry prior to the war and accordingly there has been arranged a symposium on "The Coal-Tar Dye Industry in the United States Prior to 1914." The secretary of the division asks anyone who has any facts bearing on this matter to write him at once. A complete picture is desired.

The Division of Physical and Inorganic Chemistry is arranging an interesting program.

There will be no meeting of the divisions of Fertilizer Chemistry and Leather Chemistry.

The Division of Petroleum Chemistry will hold a joint symposium with the Gas and Fuel Section on "Motor Fuels." The division also hopes to take part in the symposium on "Materials of Chemical Engineering Construction" to be held by the Division of Industrial and Engineering Chemistry.

The Gas and Fuel Section will have a program, including a symposium on "Motor Fuels."

A meeting of the local section chairman and secretaries will be held at New Haven, at an hour and place to be announced on the final program. Round table discussion will take place on the following topics: Sectional programs, sectional finances, sectional community service, employment, and intersectional meetings. The committee on a standard set of local section bylaws will make its report. Chairmen and secretaries are asked to come prepared to take part in this informal discussion. W. Lee Lewis will preside and E. M. Billings will act as secretary.

Papers for the Meeting

Titles for papers should be sent to the secretary of the appropriate division or section and not to the secretary of the society. Titles to appear on the final program must be in the hands of the individual secretaries not later than

Oil Chemists to Meet in Hot Springs

The fourteenth annual meeting of the American Oil Chemists Society will be held at the Eastman Hotel, Hot Springs, Ark., on Monday and Tuesday, April 30 and May 1, 1923.

March 15. It should be stated whether or not a lantern will be required.

Those desiring to present papers should communicate with the proper division or section immediately in order to obtain any special instructions which may apply.

The Council recently empowered officers of divisions to request any paper in advance, in order that it might be passed upon and an indication made to the author as to whether he is to read the entire paper or to abstract it in order to give time for discussion.

By vote of the Council no papers may be presented at the meeting titles for which are not printed on the final program.

"By Title" should be placed on the announcement of any paper where the author is to be absent, so that members may understand in advance that the paper will not be read.

The following are the addresses of the divisional and sectional secretaries:

Divisions

Agricultural and Food Chemistry, C. S. Brinton, U. S. Food Insp. station, 134 S. 2nd St., Philadelphia, Pa.

Biological Chemistry, W. V. Bovie, 332 Elliot St., Milton, Mass.

Cellulose Chemistry, L. F. Hawley, Forest Products Laboratory, Madison, Wis.

Dye Chemistry, R. Norris Shreve, 43 5th Ave., New York City.

Fertilizer Chemistry, H. C. Moore, Armour Fertilizer Works, 209 W. Jackson Blvd., Chicago, Ill.

Industrial and Engineering Chemistry, E. M. Billings, Kodak Park, Rochester, N. Y.

Leather Chemistry, Arthur W. Thomas, Department of Chemistry, Columbia University, N. Y. C.

Chemistry of Medicinal Products, E. H. Volwiler, 4753 Ravenswood Ave., Chicago, Ill.

Organic Chemistry, R. R. Renshaw, Chemistry Department, N. Y. University, University Heights, New York City.

Petroleum Chemistry, W. A. Gruse, Mellon Institute, Pittsburgh, Pa.

Physical and Inorganic Chemistry, Graham Edgar, University of Virginia.

Tentative Program Arranged for A.C.S. Spring Meeting

Rubber Chemistry, Arnold H. Smith, Rubber Service Laboratories Co., 611 Peoples Savings & Trust Bldg., Akron, O.

Sugar Chemistry, Frederick J. Bates, Bureau of Standards, Washington, D. C.
Water, Sewage and Sanitation Chemistry, W. W. Skinner, Bureau of Chemistry, Washington, D. C.

Sections

Chemical Education Section, Prof. Neil E. Gordon, University of Maryland, College Park, Md.

Gas and Fuel Section, R. S. McBride, Colorado Bldg., Washington, D. C.

History of Chemistry Section, Dr. L. C. Newell, 688 Boylston St., Boston, Mass.

Section of Local Section Chairmen and Secretaries, Erle M. Billings, 484 Woodbine Ave., Rochester, N. Y.

Local Committees

Edward W. Morley, Honorary Chairman.

Ralph W. Langley, Chairman Hotels and Transportation Committee.

Treat B. Johnson, Chairman Executive and Program Committees.

Julian S. Gravely, Chairman Finance Committee.

C. H. Mathewson, Chairman Entertainment and Reception Committees.

A. J. Hill, Chairman Divisional Programs and Room Committee.

W. T. Read, Chairman Publicity Committee.

W. H. Whitcomb, Chairman Excursions Committee.

Blair Saxton, Secretary and Chairman Registration Committee.

P. T. Walden, Chairman Smoker Committee.

Mrs. John Johnston, Chairman Ladies' Entertainment Committee.

Reduced Railroad Rates

Reduced railroad rates to the New Haven meeting are assured, as in view of the expected large attendance the railroads have agreed to sell round trip tickets at one and one-half fare on the identification certificate plan applicable to all parts of the United States. Tickets may be purchased March 29 to April 6 on presenting an identification certificate obtained from the secretary of the society or from the secretary of any local section, and will be good returning until midnight of April 13. From Colorado (except Julesburg), Idaho, Montana, New Mexico, Utah and Wyoming, Oklahoma and Texas the limits are March 28 and April 14. From Arizona, British Columbia (on Great Northern Railway only), California, Nevada, Oregon and Washington, the limits are March 27 and April 15. Tickets must be validated at New Haven by agents at the regular ticket offices of the lines over which tickets read into New Haven. When validated they will be good for return leaving on any day within final limit. Passengers must

reach original starting point within transit time shown on ticket, and in no case later than midnight of April 13, or, in case of special exceptions above stated, April 15.

Tentative Program

MONDAY, APRIL 2

- 10 a.m.—Registration bureau opens in Byers Memorial Hall, Yale University, corner College and Grove Sts.
- 2:30 p.m.—Council meeting in Y.M.C.A. auditorium, second floor, Byers Memorial Hall.
- 7:30 p.m.—Councilors' dinner in Ball Room of Hotel Taft.

TUESDAY, APRIL 3

- 9 a.m.—Registration and reception of members and guests at Byers Memorial Hall.
- 10 a.m.—General public meeting, Woolsey Hall, Yale University. Addresses of welcome.

Response, E. C. Franklin, president, American Chemical Society. General addresses by John W. Weeks, Secretary of War, and Francis P. Garvan, president, Chemical Foundation. Complete list on the final program.

- 1 p.m.—Dutch treat luncheon for ladies and men at University Dining Hall.
- 2:30 p.m.—General scientific meeting, Woolsey Hall, Yale University. Special addresses will be given, of which the following is one: Carl A. Alsberg, "Chemistry and Our Food Resources."
- 2:30 p.m.—Ladies will visit Harkness Memorial Quadrangle, Yale Art School, Yale Library or New Haven Historical Society Building. (Guide service will be provided.)
- 4:30 p.m.—Tea for ladies and men at Faculty Club on Elm St.
- 8:30 p.m.—Smoker for men at Yale University Dining Hall (special features). Admission by ticket.
- 8:15 p.m.—Theatre Party, complimentary to visiting women.

WEDNESDAY, APRIL 4

Dedication of the Sterling Chemistry Laboratory. John Johnston, chairman dedication committee. This day will be devoted to functions arranged by Yale University, the chief of these being the dedication of the new Sterling Chemistry Laboratory. The order of the day's program will be as follows:

- 11 a.m.—Dedication ceremony in the Sterling Chemistry Laboratory. The building will be presented to the university by the Sterling trustees and accepted by President Angell, who will turn the building over to the American Chemical Society for its divisional and sectional meetings. After a reply by President Franklin there will be a special address by Dr. Edgar F. Smith dealing with the history of chemistry in America, with especial reference to Yale.

1 p.m.—Luncheon in the University Dining Hall complimentary to invited guests, ladies and members of the American Chemical Society.

2 p.m.—During the afternoon the laboratory will be open for inspection.

4:30 to 6:30 p.m.—Informal tea in the Sterling Chemistry Laboratory.

8:30 p.m.—Public meeting in Woolsey Hall, open to men and women.

Award of the Joseph Priestley Gold Medal.

Address by a speaker of national reputation (to be announced in the final program).

THURSDAY, APRIL 5

9:30 a.m.—Divisional and sectional meetings—Sterling Chemistry Laboratory, Sloane Physics Laboratory, Osborne Memorial Laboratory and Hammond Metallurgical Laboratory.

2 p.m.—Divisional and sectional meetings—Sterling Chemistry Laboratory, Sloane Physics Laboratory, Osborne Memorial Laboratory and Hammond Metallurgical Laboratory.

3 to 6 p.m.—Ladies will be entertained with an automobile drive to places of interest around New Haven, and with a tea at the Country Club, opposite Lake Whitney.

6:30 p.m.—Fraternity and college alumni dinners, University Dining Hall.

8:30 p.m.—Indoor polo game by Yale University R.O.T.C. given in the Yale Armory, off Derby Ave., near the Yale Bowl. (This contest open to ladies and men and admission will be by ticket.)

FRIDAY, APRIL 6

9:30 a.m.—Divisional and sectional meetings—Sterling Chemistry Laboratory, Sloane Physics Laboratory, Osborne Memorial Laboratory and Hammond Metallurgical Laboratory.

1 p.m.—Luncheon for ladies at the Lawn Club, on Whitney Ave.

2 p.m.—Divisional and sectional meetings—Sterling Chemistry Laboratory, Sloane Physics Laboratory, Osborne Memorial Laboratory and Hammond Metallurgical Laboratory.

8:30 p.m.—Reception tendered by the New Haven Section to the visiting members of the American Chemical Society and their guests. An evening of informal sociability in Memorial Hall of Yale University. Dancing from 9:30 p.m. to 12. Supper will be served at 10:30 p.m.

SATURDAY, APRIL 7

Excursions to industrial plants, informal inspections, etc.

Final Program

The final program will be sent about March 24 to the secretaries of local sections, to the Council, to members of the New Haven Section, and to all members making special request therefor by mailing a postal card or the form printed herein.

N. Y. Chemists Discuss European Situation

W. S. Landis' Observations on Conditions in Germany Arouse Much Discussion

The American Electrochemical Society was host at a joint meeting of the four chemical societies having sections in New York City, in Rumford Hall on Feb. 9. There were two speakers on the program, Harold E. Bishop, of the Radium Company of Colorado, who spoke on the present situation in the radium industry, and W. S. Landis, chief technologist of the American Cyanamid Co., who gave some impressions gathered on his recent trip to Europe.

As Mr. Bishop explained in his introductory remarks, there was no particular connection between the two subjects of the evening's discussion unless it might be found in the fact that the present status of the radium industry in the United States is due to European competition. The original source of radium was the pitchblende deposits in Bohemia, which were finally abandoned in favor of the more extensive, although poorer, carnotite deposits in Colorado. Now the Colorado deposits have in turn been abandoned because of the discovery of some extensive deposits of a very high-grade ore in the Belgian Congo. A plant has been erected near Antwerp which will have a capacity of about 15 mg. of radium per month. The capacity of existing American plants has ranged from 1 to 1.5 mg. of radium per month.

Problems in the Sale of Radium

The sale of radium presents some very extraordinary problems. Its commercial development is comparatively recent, dating back only about 15 years. It has been necessary for the radium companies to educate the public to the therapeutic value of radium and to educate the physicians of the country in its intelligent use. In the hands of an unskilled physician, radium is a dangerous agent. The sales organizations that have been built up by the American companies will be kept intact by a working agreement with the Belgian producers under which the American companies will market their product in this country.

Mr. Bishop outlined the method of mining and working the Colorado carnotite and the method of preparing the finished radium bromide for application in the treatment of cancer.

Conditions in Europe

Dr. Landis, after apologizing for the presumption of a chemist who attempts to discuss problems that puzzle economists, gave a very interesting discussion of conditions in Europe as he observed them on a recent 5 weeks' trip. England, he said, has not yet recovered from the post-war depression. Prices there are very high. The most encouraging sign in industry is the recent revival of the shipbuilding. The spinning industry is in bad shape because of

German competition, serious on account of the low cost of labor in Germany.

Dr. Landis spoke enthusiastically of the industrial prosperity of Italy. Since the Fascisti have restored the industries to their rightful directors and are gradually driving the Communists out of power in the elections, industries are flourishing. The hydro-electric development of Italy's natural resources is being carried out on a large scale, he said.

Dr. Landis recounted the ludicrous complications arising in Germany from the wild fluctuations of the value of the mark. Wherever possible, he said, wages are being paid in advance, because otherwise, after working for 2 weeks at a certain wage, the workman finds that the value of the mark has depreciated to such an extent that he is unable to purchase even the necessities of life with his wages. Some of the German companies are paying wages in food and necessary supplies. Selling prices, wages and overhead are rising to keep pace with the fall of the mark. German business men are afraid of any attempt to stabilize the mark, because the upward momentum of selling prices, wages and overhead would soon carry the cost of production higher than the selling price and a panic would undoubtedly follow.

Dr. Landis emphasized the fact that since railroad rates are so ridiculously low there must be a tremendous drain on the capital of the railroads. Similarly, tremendous demands are made on capitalists to meet their payrolls, etc. He predicted that the occupation of the Ruhr will cut off the coal supply of Germany and shut down all the steel and chemical plants in Germany, except those south of Berlin.

Much Discussion Aroused

J. S. Negru, managing editor of *Chem. & Met.*, who led the discussion of Dr. Landis' paper, disagreed with the latter on several points. He pointed out that the figures quoted by Dr. Landis showing that in 1913 Germany exported 75,000,000 tons of material while in 1922 this total fell to 20,000,000 tons were deceptive, because they do not show the value of the goods. He inclined to the opinion that the 20,000,000 tons of material exported in 1922 was of far greater value in dollars per unit weight than was that of the 1913 exports. Paper and discussion aroused unusual interest and after the adjournment of the meeting informal discussion continued late into the evening, in the dining room.

Brick Kiln Laboratory Car Dismantled

The railroad car "Holmes," equipped with a field ceramic laboratory and used by the ceramic experiment station, Bureau of Mines, Columbus, Ohio, has been dismantled. The car has been making efficiency tests on fuel-burning practice at different brick kilns in the central district, and has recently completed its survey.

To Investigate Basis for Changes in Chemical Tariff

The Tariff Commission has begun work on a questionnaire to be used in field investigation of eight chemical commodities regarding which applications for changes in tariff rates under the flexible section of the new law have been submitted and which have reached this stage. The identity of the commodities involved will be announced about March 1, when the questionnaires have been prepared and are ready to be sent to the interests involved, according to present plans.

It is the intention of the commission to send agents into the field following these questionnaires, to assist in their preparation and to secure other data needed by the commission. When the field work is advanced sufficiently to form the basis for judgment as to the merits of the applications, those cases which present costs of production making it appear that the tariff rate is either too high or too low will be docketed for public hearing. It is not believed that any hearing will be held before April 15.

More applications for changes in the chemical schedule have been received than for any of the other schedules of the new tariff act, it is announced by the Tariff Commission.

Compiles Useful Data on "Where to Buy"

With the purpose of helping to meet the growing demand for information on research equipment and instruments the Research Information Service of the National Research Council has assembled catalogs and lists of research appliances issued by makers and dealers. Publications of nearly 500 domestic firms and nearly 200 foreign firms are now on file. They have been classified for effective use and a subject catalog of apparatus has been prepared. The Service has also an up-to-date list of manufacturers and distributors of research chemicals. If the Service cannot supply just the information desired, it can generally suggest some useful source of information—manufacturer, dealer or designer.

Chemical engineers and directors of chemical research who desire assistance in locating special instruments, apparatus or supplies for use in their laboratories are invited to avail themselves of the resources of this organization. The appropriate address for inquiries is Information Service, National Research Council, Washington, D. C.

Oil Refineries as Public Utilities

The State Legislature of California is considering a bill introduced by Assemblyman S. L. Helsing of Sema, classing oil refineries in the state as public utilities and placing them under the jurisdiction of the State Railroad Commission.

Women's Clubs Urge Appreciation of Chemistry

Appeal to American Women Points Out
Importance of Chemistry in Home
and Everyday Life

A new and important phase of the growing appreciation of chemistry by the American public is emphasized by a pamphlet just issued by a committee of women representing various national women's organizations. The pamphlet is addressed to American women as members of the responsible American public. It urges that women assess anew the value of the intimate and unending service of chemistry to home, community and country and that they assume the obligations resting upon them to bring America abreast of the world's foremost nations in this branch of knowledge which literally underlies our physical and our economic life. The brochure is sent out under the names of Mrs. Thomas G. Winter, president of the General Federation of Women's Clubs; Miss Maude Wetmore, chairman of the women's department of the National Civic Federation; Mrs. Herbert Hoover, national president of the Girl Scouts; Miss Ada L. Comstock, president American Association of University Women, and Mrs. George Maynard Minor, president-general of the Daughters of the American Revolution.

Behind in Organic Research

The burden of the message as set forth in the pamphlet is to the effect that this nation has fallen behind in the promotion of research in that branch of chemistry on which rests the preservation of health, the practice of medicine, the elimination of waste from the home and industry by the conversion of that waste into humanly usable products, the improvement and increase in our food supplies, and the conservation of our resources through a wider and more effective utilization of materials.

The pamphlet goes on to give a "sweeping glance over the broad fields of human concerns in which chemistry plays a part." The nitrogen cycle, the formation of coal, the synthesis of perfumes and dyes, fertilizers, rubber and other important chemical products and raw materials are described in simple language. Special emphasis is placed on the chemist as a civic beautifier, particularly in reference to smoke prevention and recovery of industrial waste products.

Pointing out that the growth of organic chemical research in America has been retarded by the lack of public appreciation, the plea concludes with suggested steps to remedy this national fault as follows:

Get the educators and scientists in your own communities in touch with the objective of your organization activity. Find out what bearing the development of chemical research has upon that objective.

Find out what research equipment personnel in your community and state and in the nation are devoted to the subjects in which you are interested.

Look into the educational systems of your own community and state, and

learn what place is assigned in the curricula to chemistry. See what your local libraries have in the way of authoritative and interesting literature on organic chemistry.

Study carefully and decide for yourselves whether the organic chemical industries are necessary as an assurance of support of the American young men and women who may be induced to choose a career in the field of organic chemistry as a result of your enlivening activities.

When you have gathered this information through group study, take counsel with other groups of women who have been studying the same subject and with the men who are concerned and active in the development of organic chemistry and an organic chemical personnel in America.

With this information and with this counsel, formulate your own idea as to what national and state policies should be put into effect for the surest development and maintenance of an American organic chemical personnel adequate to our national needs.

Act in accordance with the judgment you have thus formed, and demand of those opposing your course of action a clear explanation of the motive and grounds of their opposition.

In concluding, the brochure voices a thought which is worthy of consideration. It is pointed out that it is the general sympathetic understanding of the creative achievements and purpose of chemistry which furnishes the favorable condition for the growth of creative research. "There are but a few great musicians, poets, painters and sculptors, but there are millions of lovers of music, poetry, painting and sculpture. The appreciation of the millions is the life-sustaining if not life-creating atmosphere of the masters of science as well as of art."

Paper Show Will Attract Many to New York

Feature Days and Educational Attractions
Make Up Elaborate Schedule
for Paper Week

A series of special days for different groups of visitors to the Paper Industries Exposition is being arranged for the paper show which will be held at Grand Central Palace the week of April 9. In arranging these special days, care is being taken to avoid conflict with the conventions of the American Paper and Pulp and National Paper Trade and their affiliated associations. On each of the special days, special programs will be arranged, with authorities on various lines of activity as the chief speakers.

Printers' and Publishers' Day has been set for Friday, April 13. Thursday will probably be selected as Clean Food Day, with the program devoted to the utilization of paper and pulp containers for the protection of food from filth. Thursday will also be a special day for the manufacturers and merchants in attendance at the conventions to be held during paper week at the Waldorf-Astoria. The tentative program for the American Paper and Pulp Association, which will have its annual meeting and banquet on Thursday, April 12, provides for the holding of a strong forenoon program, but leaves the afternoon open for those in attendance at the convention to visit the Paper Industries Exposition. The

manufacturers will then be able after their visit to the exposition to return to the annual banquet in the evening. The holding of Printers' and Publishers' day on Friday gives the merchants and manufacturers an opportunity to spend the day in visiting with their customers at the exposition.

Badges to Admit to Show

In order to facilitate the attendance of the merchants and manufacturers at the exposition, the management has arranged to make the badges of the different associations the only requisite for admission, those wearing association badges being admitted free as guests of the managers of the big paper show. In order still further to facilitate their attendance, the American Paper and Pulp Association has arranged that not only the badges but the registration cards of those in attendance at convention sessions be recognized as passes to the exposition.

While these arrangements for the program of the Paper Week have been in the process of completion, the work of assigning exhibits to space in the exposition has not been lagging. There are now upward of fifty-five exhibitors who have either closed contracts for space or made reservations of space pending the closing of formal contracts. Two or three of the biggest of the paper-manufacturing companies are among those which are now planning to place exhibits, and one of these at least is considering the taking of several booths in order effectively to show its product.

Educational Features

The latest of the educational exhibits to be definitely closed is that of the Bureau of Foreign and Domestic Commerce, which has accepted the offer of space made by the exposition management and which is planning to make an effective presentation of the work done by the whole bureau in general and more specifically the activities of the paper division of the bureau.

Basing its plans on the belief that the exposition is to be an educational exhibit for the public, as well as a special showing of paper to printers and publishers and of paper-making machinery and supplies to the paper manufacturers, special invitations are being sent to the various schools interested in paper, either by its use or in its manufacture, to have their students attend. The students of Columbia University's chemical engineering course, for instance, will be invited to take advantage of the exposition.

Not the least notable of the student group to be invited will be the pupils in the printing schools conducted in New York and vicinity. They will probably be invited to attend on Printers' and Publishers' Day, when the printers will be invited to bring their questions, with the manufacturers of paper on hand ready to answer the questions of the printers, who after all are the largest group of customers of the paper industry.

"Tell Ford Yes or No," Sentiment in Senate

Proposal of Appropriation for Experimental Work on Plant No. 1 Brings Up Muscle Shoals Again

While the probabilities are much against any action on Henry Ford's Muscle Shoals proposition at this session of Congress, the friends of that offer contend that they still have a chance to obtain a vote not only in the House but in the Senate as well. The unexpected happens many times during the closing days of a Congress when unexpected alignments are formed in the frenzied efforts to get certain legislation through the jam. It is entirely conceivable that some trade may be effected which would permit of a vote on the Ford offer.

It is known that Senator Underwood's contention, made recently on the floor of the Senate, that since Mr. Ford's bid was submitted as a result of a formal request from the government it should be accepted or rejected, has impressed a number of Senators who are not advocates of the Ford proposal. During that debate it was contended that it is a universal rule of business ethics that when bids are invited, the bidders must be told whether their proposals are accepted or rejected. Senator Underwood characterized the long delayed action on the Ford offer as being a very cavalier way in which to treat any bidder. Senator Williams said it was worse than cavalier and suggested "puritanical" as the proper adjective.

No Excuse for Delay

Senator Underwood called attention to the fact that there no longer is any controversy about the completion of the Wilson dam, since each house has authorized the engineers to make the final contract for its completion. He pointed out that within 3 years at most a great electrical plant will be ready for operation at Muscle Shoals, and the issue before Congress is whether it is to be operated by private effort or as a government institution.

The debate in the Senate was brought about by an amendment proposed by Senator Norris suggesting an appropriation of \$2,000,000 for the installation of new machinery in Nitrate Plant No. 1, so that the plant could be used for experimental purposes. He argued that such a proposal should not be objectionable to Mr. Ford, since he would have to conduct such experiments if his offer were accepted. The amendment was opposed on the ground that it would complicate the situation by additional expenditures, additional experimentation and additional contracts. The trend of the debate made it clear to Senator Norris that the amendment could not prevail and he therefore withdrew it.

Ladd Thinks Haber Process Hopeless

Senator Edwin F. Ladd, the only chemist in the Senate, rose to discuss the proposed appropriation. He urged speedy decision on the disposal of the

Equipment Association Appoints Committees

Announcement is made from the headquarters of the Chemical Equipment Association, 1328 Broadway, New York City, of the appointment of the following standing committees:

Ethics: D. W. Sowers, Sowers Manufacturing Co.; A. B. McKechnie, Parks-Cramer Co.; W. B. Tardy, Schutte & Koerting Co.

Standardization: E. H. Froman, Fuller-Lehigh Co.; Hamilton Allport, E. B. Badger & Sons Co.; Hubert Royer, General Ceramics Co.

Membership: J. George Lehman, Bethlehem Foundry & Machine Co.; M. A. Knight, Maurice A. Knight; T. C. Oliver, Chemical Construction Co.

Industrial Relations: Edward J. Fowler, Pacific Foundry Co.; E. J. Sweetland, United Filters Corporation; J. W. Bodman, William Garrigue & Co.

Business Extension: J. W. Spotten, United Lead Co.; H. N. Spicer, Dorr Co.; H. P. MacGregor, Merrill Co.

Statistics: R. Gordon Walker, Oliver Continuous Filter Co.; C. W. Pearson, Buffalo Foundry & Machine Co.; P. S. Barnes, Pfaudler Co.

Legislation and Publicity: Irving Fellner, Chem. & Met.; H. T. Matthew, Quigley Furnace Specialties Co., Inc.; Paul O. Abbé, Inc.

Some of these committees are not yet active, because their members have not yet been able to get together, but the scope of activity and the methods to be followed by each of the committees are nearing final definition, and within the next few weeks it is hoped to have undertakings under way which will involve the co-operation of government officials and bureaus, leading figures in the various equipment using industries, and the members of the association.

The association has adopted insignia for use on the stationery of members and in advertising, etc. The insignia consist of a monogram of the initials of the association and the motto, "Better to Serve Industry."

Muscle Shoals property, but opposed the expenditure for experiments on the Haber process at Plant No. 1. He declared that the plant was built upon an assumption and resulted in a failure.

The Senator from North Dakota then went into considerable detail regarding explosions that have occurred in plants where the Haber process is used. He quoted newspaper accounts of the Oppau explosion and dwelt upon accidents which have occurred in the Haber plants in this country.

"Only a volcano could be compared with the Oppau explosion," he declared. "I maintain, Mr. President, that the science of nitrogen fixation has progressed far enough so that it is not necessary to erect a volcano in a civilized community to supply this country with nitrogen for its military explosives."

To Fight Ford in Defense of Waterpower Act

National Committee Formed for the Purpose Points Out Evil of Establishing Precedent

Declaring that the terms proposed by Mr. Ford to the government for the leasing of the Muscle Shoals power site are in flagrant violation of the principles of the federal waterpower act of 1920, a voluntarily organized committee including in its personnel many of the men who, in official positions, worked for the passage of the waterpower act has voiced strong disapproval of the Ford proposal. The committee includes former Secretaries of War Garrison, Stimson and Baker; former Secretaries of the Interior Garfield and Fisher; former Secretaries of Agriculture Meredith and Houston; Governors Parker of Louisiana, Dixon of Montana, Gifford Pinchot of Pennsylvania, former Governors Allen of Kansas and Pardee of California.

A pamphlet is being circulated, written by Herbert Knox Smith of Hartford, Conn., who was Commissioner of Corporations under the Roosevelt and Taft administrations and who conducted an exhaustive investigation of the waterpower problem. In this article the original objects of the waterpower act are set forth and contrasted with the provisions of the Ford Muscle Shoals proposal. It is pointed out that the real vice of this proposal is not in the immediate money loss, but that it is a flagrant violation of the waterpower act, which was passed purely for the protection of the public. The points of violation are enumerated as follows:

It is a grant for 100 years.

It provides for no rental payments whatsoever for the use of the site, and only an absurdly small rental for the use of the works built with government money.

There is no provision whatsoever to prevent the making of excessive profit on the Ford company's actual investment, nor to require any transfer of such excess to the public.

There is no regulation whatsoever of the distribution or use of the power.

There is no provision that it shall be used for public service in any way.

The Ford company is not required in any way to contribute to the cost of storage reservoirs hereafter built upstream. Such reservoirs would enormously increase the value of the Ford company's site, and the government is now making a survey for such storage developments.

The point made in the article is that the real danger of the scheme lies in its force as a precedent, since it would apply to all other developments, existing and future.

Germany to Pay Italy in Books

Italy has agreed to accept as part of the reparations due her from Germany books and scientific publications to the value of 4,000,000 gold marks. Italy will furnish a list of her requirements. The gaps in the collections in her public libraries have been carefully cataloged, and it is these gaps that Germany will fill. Many valuable scientific works published before the war will be assigned to Italy's scientific institutions and museums.

Liquid Oxygen as an Explosive

As an appropriation will be available July 1 for a further study of liquid oxygen explosives by the Bureau of Mines, the tests made recently at Martinsburg, W. Va., by Adolf Messer, a German manufacturer, were of particular interest to the specialists of the bureau who were present. George S. Rice, the bureau's chief mining engineer, who has done a great deal of work on liquid oxygen and who will be in immediate charge of the work to be done under the new appropriation, attaches great significance to the Martinsburg tests, since they show how successfully liquid oxygen can be used in deep holes. He believes that the use of liquid oxygen in shallow holes has been worked out thoroughly and demonstrated to be entirely practicable. For that reason he plans to devote most of the bureau's appropriation to the study of the technique involved in the shooting of deep holes with liquid oxygen.

Mr. Rice has no idea that there will be any extensive supplanting of dynamite by liquid oxygen, but under certain conditions he believes liquid oxygen can be used to greater advantage than other explosives. This is particularly the case in cities and congested areas, where the transportation of ordinary explosives is undesirable. He expects it to appeal to users where there is difficulty in preventing thefts of ordinary explosives and at times when outrages might follow the availability of explosive supplies which could be pilfered by misdirected persons.

Under some conditions, however, Mr. Rice believes liquid oxygen will be used in mining operations. He calls attention to the fact that nearly two-thirds of the iron ore mined in Lorraine is shot down with liquid oxygen. It is his opinion that conditions are ideal for the use of this explosive in Alabama iron mines. That it is reaching the point of practical use may be judged from the fact that a plant is about to be installed at a mine in northern New York. He does not believe its use is desirable in any coal mine, whether gaseous or not.

New Jersey Third State in Clay Production

According to a preliminary report compiled by the State Department of Conservation and Development, New Jersey, that state stands third among those of the Union producing clay and burned clay materials. The total value of pottery production for 1920, the year which the report covers, was \$24,597,376, while that of brick and tile aggregated \$15,423,652, a total of \$40,021,028. According to the statistics, Ohio ranks first in the line of ceramic production with a total of 21.9 per cent of the aggregate output of clay products in the United States; Pennsylvania comes next with 13.6 per cent; and New Jersey follows with 10.7 per cent.

Personal

WILLIAM BARR, formerly with the Los Angeles branch of the Hughes Tool Co., is now production manager for the Regan Forge & Engineering Co., San Pedro, Calif.

JOHN A. COE has been re-elected president of the American Brass Co., Waterbury, Conn., and CHARLES F. BROOKER has been re-elected chairman of the board.

A. CLAYTON CLARK, superintendent at the plant of the Raritan Copper Works, Perth Amboy, N. J., has been elected president of the local board of education.

W. D. COLLINS, of the U. S. Geological Survey, delivered an address before the Washington Academy of Sciences, Feb. 15, on the subject "The Industrial Aspects of Modern Methods of Water Purification."

L. C. COOLEY has accepted a position as plant engineer with the United States Industrial Chemical Co., Baltimore, Md.

EDWARD A. DIETERLE has resigned his position as chief chemist of the Chicago By-Products Coke Co. and is resuming consulting engineering work with headquarters in Chicago.

W. E. EMLEY of the Bureau of Standards recently delivered a paper before the Sand-Lime Brick Association.

ALBERT P. MATTHEWS, professor of biochemistry, College of Medicine, University of Cincinnati, gave an interesting address at the meeting of the Indianapolis, Ind., section of the American Chemical Society, Feb. 9, at the Indianapolis Chamber of Commerce on the subject of "New Light on the Origin of the Organic Substances on the Earth's Surfaces."

GEORGE S. RICE, the chief mining engineer of the Bureau of Mines, has been selected as the bureau's delegate to attend the Mining Exposition and Conference which will be held in London, June 1 to June 14. He will sail from New York on May 12. Following the exposition he will visit other countries of Europe to continue his study of mining methods. He also will devote a considerable portion of his time to a study of the improvements made in the manufacture and use of liquid oxygen.

Dr. HUGO SCHLATTER will deliver a lecture before the Philadelphia Section of the A.C.S. on "The Manufacture of Artificial Silk" and will also be the principal speaker at the March meeting of the N. J. Chemical Society.

Dr. EDWIN E. SLOSSON of Washington, D. C. recently addressed the Technology Club of Syracuse N. Y. on "Creative Chemistry."

JAMES VAIL of the Philadelphia Quartz Co. gave a paper last week before the American Ceramic Society. He will shortly sail for Europe to be gone about 2 months.

Obituary

ROBERT W. HILTON, president of the Hilton-Davis Co. and formerly vice-president of the Ault & Wiborg Co., died Feb. 5, following a 3-day illness at his home in Cincinnati. He was 49 years old. A complication of influenza and pneumonia caused his demise.

LYSLE R. KRAUS, secretary of the Kraus Research Laboratories, Inc., died Tuesday, Feb. 6, from the result of a railroad accident. Mr. Kraus was born Nov. 21, 1893, at Cockeysville, Md., was graduated from the Sparks Agricultural College in 1914 and was one of the founders of the Kraus Research Laboratories, Inc., and associated himself with the company in the capacity of ceramic engineer. In the ceramic field Mr. Kraus invented several processes for the plasticizing of clays and developed many bonding clays of exceptional value. His research work in refractories was very exhaustive—making improvements over present-day methods and producing several new refractory bases.

H. J. SEAMAN, for many years general superintendent of the Atlas Portland Cement Co., of 30 Broad St., New York City, died on Feb. 9, in Atlantic City. Mr. Seaman was a graduate of Lafayette College, Easton, Pa., and had played an important part in the building up of a very essential manufacturing industry, which has always been classed as a chemical industry since the early stages of its development. Previous to his connection with the Atlas Portland Cement Co., Mr. Seaman was associated with Mr. Hurry, a prominent English engineer, and together they introduced the use of pulverized coal for burning portland cement clinker in rotary kilns.

ARTHUR C. STALLMAN, president of Arthur Stallman & Co., crude drug merchants of New York, died Feb. 8, at his home in Mt. Vernon, N. Y., from pneumonia, at the age of 52. He was born Sept. 22, 1871, in New York. Mr. Stallman was the son of the late John Henry Stallman and Sophie M. C. (Frentz) Stallman. He became associated with his father in the crude drug firm of Stallman & Fulton, one of the earliest and best-known houses in that trade. His father died in 1908 and the firm was dissolved. In 1912 Mr. Stallman started the business that now bears his name.

MILTON FRANKLIN WILLIAMS, president of the Williams Patent Crusher Co., St. Louis, Mo., died Feb. 8, from septic pneumonia, although he had been confined to his home for the past 18 months suffering from diabetes. Mr. Williams went to St. Louis more than 50 years ago and started as a millwright in a small machine shop. He originated the swing hammer crusher and pulverizer in 1895, and in 1897 incorporated his machine works under the present name.

Market Conditions

In Chemical, Metallurgical and Allied Industries

A Survey of the Economic and Commercial Factors That Influence Trade in Chemicals and Related Commodities
Prevailing Prices and Market Letters From Principal Industrial Centers

Chemical Exports Show Gradual Recovery in 1922

Improvement at a Time When Total Exports Show Marked Decline
Is Generally Regarded as Indicative of Better Business
Conditions in Chemical and Allied Industries

CHEMICAL and kindred industries showed a surprising improvement in export trade during 1922. In the face of a decrease in general exports from \$4,378,928,024 in 1921 to \$3,765,192,135, the shipments of American chemicals showed a gain in aggregate value of 1.4 per cent. The figure for the year was \$106,101,562, as contrasted with \$104,639,941 during 1921. The chemical division of the Commerce Department points out that among the subsidiary commodity groups contributing to this gain, explosives rose 50 per cent in value over 1921, perfumery and cosmetics increased 33 per cent, medicinals and pharmaceuticals 11 per cent and fertilizers 3 per cent.

Pigments, paints and varnishes, it is also pointed out, have shown a steady although rather sluggish tendency to improve. However, the total for 1922 is 5 per cent below last year's. It is of interest to note that the 26 per cent decrease (from corresponding 1921 values) that marked the first half was compensated in large measure by the 31 per cent increase of the last half of 1922. The exports for December, 1922 (\$1,096,320), were the greatest for any one month since February, 1921.

Coal-Tar Products Lagging

General chemicals failed to reach their 1921 level by 4 per cent, exports for 1922 having a total value of \$51,712,005, contrasted with \$54,041,996 a year ago. Foreign sales of benzol (64,740,402 lb., valued at \$2,362,821) were 10 per cent in quantity and 21 per cent in value below those of 1921 (72,030,400 lb., worth \$3,007,086). Coal-tar colors, dyes and stains other than color lakes likewise lost ground, dropping from \$5,067,000 to \$3,981,217, but crude coal tar increased from \$191,482 (92,406 bbl.) to \$208,666 (99,960 bbl.). Carbo-lic acid exports decreased from \$35,994 (249,658 lb.) in 1921 to \$23,223 (223,146 lb.) in 1922.

Among other coal-tar products, \$65,636 worth (341,820 lb.) of aniline oil and salts, \$224,546 worth (554,166 lb.) of medicinals, and \$103,853 worth (248,119 lb.) of photographic chemicals were shipped from the United States to foreign countries in 1922. The corre-

Encouraging Comment

Only three groups of American exports in 1922 showed an increase over the previous year; "chemicals and allied products" was one of the three. True, the gain was only 1.4 per cent, yet when this is set off against decreases ranging from 8 to 31 per cent for other groups, a feeling of satisfaction at the year's outcome is not unwarranted.

With a continuance of the spirit of organization and co-operation manifested during the past year there would seem to be no reason why the chemical industry should not now go steadily forward.—*C. C. Concannon, Acting Chief, Chemical Division, Department of Commerce.*

sponding 1921 figures for these items are not available.

Foreign sales of wood and denatured alcohol doubled in value and tripled in quantity, rising from \$454,584 for 412,110 gal. in 1921 to \$922,700 for 1,270,314 gal. in 1922. A large decrease occurred in exports of other alcohol—from \$2,338,838 for 5,611,897 proof gallons to \$497,955 for 2,090,666 proof gallons.

Heavy Chemicals Show Important Gains

Heavy chemicals showing important expansions in quantity in 1922 over 1921 included copper sulphate, which increased 46 per cent, acetate of lime 51 per cent, bleaching powder 123 per cent, glycerine 20 per cent, potassium chlorate 50 per cent, sodium silicate, or water glass, 40 per cent, sal soda 10 per cent, and sodium bicarbonate 35 per cent; but the largest increases of all under this classification were in borax, which increased more than 300 per cent, and caustic soda, which rose nearly 200 per cent. Specific figures of the exports of these and other chemicals are given in Table I, which will be found on page 376.

Exports of sulphuric acid dropped off from \$317,720 (12,814,344 lb.) in 1921 to \$201,267 (12,470,389 lb.) in 1922.

Throughout 1922 the foreign demand for explosives was encouraging, growing until during December the peak was reached with 2,939,283 lb., valued at \$504,942, exported. Total shipments abroad for the year were 19,212,449 lb., worth \$3,400,391, compared with 10,433,830 lb., worth \$2,285,849, in 1921. Of this group, the only class for which comparative figures are available is dynamite, with increases of 47 per cent in quantity (from 9,567,442 to 14,105,017 lb.) and 33 per cent in value (from \$1,815,999 to \$2,406,398). There were also shipped abroad during 1922 925,840 lb. (\$369,848) of smokeless powder, 410,705 lb. (\$129,216) of other gunpowder, 3,227,956 lb. (\$366,686) of blasting powder, and 125,308 lb. (\$54,267) of cordite, guncotton, etc.

Phosphate Rock Competition Expected

The expected drop in foreign demand for phosphate rock as a result of the recent development of the Moroccan phosphate mines has not yet materialized. The development of the Moroccan phosphate deposits is receiving serious attention, and competition with American phosphates is expected. During the next few years it will be interesting to observe the actual effect on American exports. Although sales of high-grade phosphate rock rose in quantity from 182,594 tons (value \$2,592,541) in 1921 to 202,300 tons (value \$2,548,587) in 1922, those of land pebble declined from 544,425 tons (\$4,267,875) to 512,777 tons (\$3,269,179) and of other phosphate rock from 6,293 tons (\$99,721) to 4,217 tons (\$40,401).

In addition to these fertilizers and fertilizer materials, there were shipped abroad in 1922 2,556 tons (\$26,112) of calcium cyanamide 1,576 tons (\$78,047) of other nitrogenous materials and 14,416 tons (\$600,972) of prepared fertilizer mixtures.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	175.31
Last week	175.64
February, 1922	148.00
February, 1921	166.00
February, 1920	252.00
April, 1918 (high)	286.00
April, 1921 (low)	140.00

Included in this index are acetic, citric, hydrochloric, nitric, and sulphuric acids, ethyl and methyl alcohols, anhydrous ammonia, ammonium sulphate, barium chloride, bleaching powder, borax, caustic potash, caustic soda, copper sulphate, formaldehyde, glycerine, potassium carbonate, salt cake, soda ash, sulphur, benzene, aniline, and cottonseed and linseed oils.

Coal-Tar Products Show More Activity

Crudes in Scarce Supply—Intermediates in Fairly Good Demand—Material Improvement Generally Noted

The general market for coal-tar products appeared rather steady, and prices throughout the list were well maintained. Crudes continued in limited supply and producers reported a heavily sold up condition at the works. Phenol, cresylic acid, solvent naphtha and pyridine were in strong demand, but sales were rather small, due to the scarcity of stocks. Intermediates were held in strong producing hands and prices were fairly well sustained. Alpha-naphthylamine, aniline oil, H acid and beta naphthol showed considerable activity at prevailing quotations.

Dull Market for Chemicals

However, a Few Bright Spots Were Noticed—Calcium Acetate Selling in Good Quantity

Trading in industrial chemicals last week was rather dull in the New York market, due undoubtedly to the intervening holiday and the extreme conservatism shown by leading consumers. The transportation situation was slightly improved, but still far below normal.

Producers of oxalic acid announced another decrease in price, said to be due to the sharp foreign competition and the lack of consuming interest. Arsenic and its compounds continued to feature the spot market. Buyers experienced some difficulty in procuring any round lots for March shipment, due to the heavily sold up condition abroad and at the works. The alkali market is progressing along moderate lines and with some improvement resulting from the better railroad transportation. Buyers have been able to transact considerable additional business. Bleaching powder, caustic potash, prussiate of soda, sal ammoniac and barium chloride continued along fairly active lines at prevailing quotations. Slightly lower prices were noted for formaldehyde and carbonate of potash.

Price Changes

Bleaching Powder—Producers continued to quote \$2 per 100 lb., f.o.b. works, in large drums. Resale goods were held around 2½c. per lb. Demand was rather active, in view of the sold-up condition at the works.

Calcium Acetate—Leading producers quoted 3½c. per lb., f.o.b. works in bags. The demand was said to be good and the dealers expressed their satisfaction at the general volume of business.

Caustic Potash—The market appeared somewhat slower than previously noted, although prices were well maintained around 7¼@7½c. per lb. Shipments from abroad were quite firm at 7½c. per lb., c.i.f. N. Y.

Caustic Soda—Domestic consumers

continued to purchase in fair-sized tonnages at \$3.75 per 100 lb. ex-store N. Y. Export business was quiet, with odd lots selling around \$3.40@3.45 per 100 lb. f.a.s.

Carbonate of Potash—Prices were fractionally lower, due to the lack of consuming interest. Calcined 80-85 per cent was quoted around 5½c. per lb., with 96-98 per cent at 7¼@7½c. per lb.

Formaldehyde—Resale material was quoted somewhat lower, due to surplus

stocks. Producers continue to quote 16c. per lb. in carlots and 16½c. in smaller quantities. Resale goods was quoted at 15½c. per lb.

Soda Ash—Leading dealers were quoting standard goods at \$1.75 per 100 lb., f.o.b. N. Y. in carload lots, single bags. The demand was merely routine, with actual transactions rather limited. Contracts continued at \$1.20 per 100 lb., basis 48 per cent, f.o.b. works in single bags.

TABLE I—EXPORTS OF CHEMICAL AND ALLIED PRODUCTS, 1921 AND 1922

Article	Unit of Quantity	Quantity	Value	Quantity	Value
Chemicals and allied products (total)			\$104,639,941		\$106,101,562
<i>Coal-tar Products:</i>					
Crudes—					
Benzol.....	Lb.	72,030,400	3,007,086	64,740,402	2,362,821
Crude tar.....	Rbl.	92,406	191,482	99,960	208,666
Toluol.....	Lb.			180	24
Solvent naphtha.....	Gal.			170,373	62,803
Other crude distillates.....	Lb.		509,508	4,147,866	91,342
Intermediates—					
Carbolic acid.....	Lb.	249,658	35,994	223,146	23,223
Aniline oil and salts.....	Lb.			341,820	65,636
Naphthalene.....	Lb.			109,514	12,657
Nitrobenzol.....	Lb.			42,980	5,296
Other intermediates.....	Lb.			847,311	168,228
Finished products—					
Color lakes.....	Lb.			28,228	19,928
Other colors, dyes, and stains.....	Lb.		5,067,000	8,324,209	3,981,217
Medicinals.....	Lb.			554,166	224,546
Synthetic phenolic resins.....	Lb.			128,153	13,183
Photographic chemicals.....	Lb.			248,119	103,853
Other coal-tar finished products	Lb.			6,280,989	285,914
<i>Acids and Anhydrides:</i>					
Acetic.....	Lb.			5,080,519	367,717
Sulphuric.....	Lb.	12,814,344	317,720	12,470,389	201,267
Nitric.....	Lb.	177,580	26,176	1,675,025	48,478
Boric.....	Lb.			1,968,996	197,265
Lactic.....	Lb.			198,674	14,221
Picric.....	Lb.	1,742	927		
All other acids and anhydrides.....	Lb.		1,171,992	9,518,087	626,057
<i>Alcohols:</i>					
Wood and denatured.....	Gal.	412,110	454,584	1,270,314	922,700
Other alcohol.....	Pt. Gal.	5,611,897	2,338,838	2,090,666	497,955
<i>Amines and Ammonium Compounds:</i>					
Aluminum sulphate.....	Lb.			7,247,480	990,111
Baking powder.....	Lb.	3,888,875	1,493,202	26,450,657	388,447
<i>Calcium Compounds:</i>					
Acetate of lime.....	Lb.	18,239,740	404,528	3,428,395	1,515,735
Calcium carbide.....	Lb.	11,808,252	606,999	27,596,106	591,599
Chloride of lime or bleaching powder	Lb.	18,447,579	483,752	12,835,916	633,297
Chloroform.....	Lb.			41,069,188	679,775
Copper sulphate (blue vitriol).....	Lb.	3,582,933	217,491	54,897	20,282
Dextrine.....	Lb.			5,250,556	256,432
Formaldehyde (formalin).....	Lb.		349,089	16,239,474	536,027
Glycerine.....	Lb.	2,394,714	361,507	1,940,577	209,386
Magnesium sulphate.....	Lb.			2,870,463	425,891
<i>Potassium Compounds:</i>					
Chlorate.....	Lb.	375,401	49,709	1,420,877	35,947
Bichromate.....	Lb.			562,986	51,066
Other.....	Lb.			4,430,208	433,552
<i>Sodium Compounds:</i>					
Cyanide.....	Lb.			286,284	296,378
Borax.....	Lb.	4,061,633	269,771	1,250,566	235,298
Soda ash.....	Lb.	35,042,791	850,369	17,242,571	867,417
Silicate.....	Lb.	20,789,095	247,761	29,627,574	678,983
Sal soda.....	Lb.	10,354,513	204,616	29,131,925	302,511
Caustic soda.....	Lb.	49,865,219	2,041,236	11,463,418	186,284
Bicarbonate.....	Lb.	11,703,183	307,138	146,739,406	5,271,528
Other.....	Lb.		2,584,953	15,853,945	341,385
Thorium nitrate.....	Lb.			97,518,488	2,439,228
Zinc chloride.....	Lb.			1,103	3,149
<i>Chemical Pigments:</i>					
Zinc oxide.....	Lb.	5,021,509	\$426,253	268,503	16,873
Lithopone.....	Lb.			7,953,847	\$593,128
Sublimed lead (basic sulphate).....	Lb.			3,231,722	169,982
White lead (basic carbonate).....	Lb.	10,321,415	993,130	524,975	36,584
<i>Paints, Stains, and Enamels:</i>					
Enamel paints.....	Lb.			9,196,656	710,765
Flat interior paints.....	Gal.			1,501,520	418,521
Other ready mixed paints.....	Gal.	1,397,043	3,150,804	14,503	34,807
Other paints.....	Lb.		3,339,610	1,337,393	2,734,325
<i>Varnishes:</i>					
Spirit varnishes.....	Gal.	665,437	1,399,110	10,188,393	1,720,360
Oil varnishes.....	Gal.				
Other varnishes.....	Gal.			46,348	80,127
Calcium cyanamide.....	Ton			376,416	657,117
Sulphate of ammonia.....	Ton			352,331	533,844
<i>Phosphate Rock:</i>					
High-grade hard rock.....	Ton	182,594	2,592,541	2,556	26,112
Land pebble.....	Ton	544,425	4,627,875	147,331	8,736,611
Other phosphate rock.....	Ton	6,293	99,721		
Superphosphates (acid phosphates).....	Ton	4,278	96,303		
Explosives (total).....	Lb.	10,433,830	2,285,849	24,373	360,402
Dynamite.....	Lb.	9,567,442	1,815,999	19,212,449	3,400,391
Nitrocellulose (cordite, gunecotton, etc.).....	Lb.			14,105,017	2,406,398
<i>Vegetable Oils:</i>					
Cottonseed oil.....	Lb.	252,548,666	24,361,974	125,308	54,267
Crude.....	Lb.				
Refined.....	Lb.			31,712,143	2,508,696
Peanut oil.....	Lb.	1,708,335	183,433	43,590,678	4,778,446
Lined oil.....	Lb.	3,512,228	406,460	963,102	100,691
Soya-bean oil.....	Lb.	1,943,768	176,753	2,702,634	332,781
Corn oil.....	Lb.	4,399,789	491,499	2,458,080	207,288
				5,732,993	678,180

Smaller Volume of Business in Chicago Market

Prices Are Well Maintained, but Dealers Are Showing Concern Because of General Inactivity

CHICAGO, ILL., Feb. 15, 1923.

Business in industrial chemicals has not been so good during the past 2 weeks and dealers displayed some concern over the change. The dullness of the market brought on some price cutting from worried holders, but in general prices were fairly well maintained. Spot stocks were in fair condition, but the poor freight service made shipments slow. Conditions abroad were getting worse instead of better and it is expected that in the near future material of foreign origin would be both high priced and scarce.

Principal Price Changes

The spot price on *caustic soda* was reduced 10c. per 100 lb. by leading factors. This reduction brings ground *caustic* to \$4.15 per 100 lb. and solid \$3.40. *Caustic potash* was very firm due to the scarcity of supplies and the situation in Germany. Spot material of the 88-92 per cent grade was held at 8@9c. per lb., price according to quantity and the seller. *Soda ash* was in fair demand and was unchanged at \$2.25 per 100 lb. for material in cooperage.

Potash alum was scarce on spot and only small lots were available at 4½@5c. per lb. for the iron-free lump. The powdered grade was available only in one direction and was quoted at 8½c. per lb. *Ammonium carbonate* was quiet and unchanged at 9@10c. per lb. for the lump. *Sal ammoniac* was available from one source at 7½c. per lb., but the general quotation was 8c. *Barium chloride* was quiet at \$110 per ton. *Barium carbonate* of foreign origin was quoted in small lots at \$100 per ton, but with a fair-sized order this could have been shaded considerably. *White arsenic* was well maintained in price and only small lots were to be had at 17@17½c. per lb. *Carbon tetrachloride* was available from one dealer at 9½c. per lb., although the general asking price was 10@10½c. *Carbon bisulphide* was unchanged at 7½c. per lb. for spot goods. *Copper sulphate* was quoted in some quarters at 6½c. per lb., but odd lots were still available at 6c. *Formaldehyde* displayed no signs of weakness and was quoted at 17c. per lb. *Glycerine* was not so firm and there was less talk of an advance; c.p. material in drums was quoted at 18½c. per lb. delivered. *Lead acetate* was quiet and unchanged at 12½c. per lb. for white crystals.

Potash Salts Advancing

Practically all potash salts were very firm, with advances noted in several cases. *Potassium bichromate* was in fair demand and supplies were quoted at 12½@13c. per lb. *Potassium carbonate* 96-98 per cent was quoted at 9@10c. per lb. for delivery from stock. *Potas-*

sium cyanide 96-98 per cent was to be had only in one direction and was quoted at 55c. per lb. in single-case lots and 2c. less for five cases. *Yellow prussiate of potash* was available at 40c. per lb. and the red was generally quoted at 90@92c. per lb. *Potassium permanganate* was firm, with moderate lots of the U.S.P. crystals available at 18@19c. per lb.

Sodium bisulphite was in fair request and powdered material was generally quoted at 6c. per lb. Material for shipment from the East was somewhat cheaper. *Sodium fluoride* was quiet at 10@10½c. per lb. *Zinc chloride* granulated was quiet at 8c. per lb. for domestic material and foreign slightly lower.

The demand for *linseed oil* was far from heavy but the price continued to advance. Boiled oil was quoted today in single-drum lots at \$1.06 per gal., with similar quantities of the raw at \$1.04.

Turpentine was in a position similar to that of *linseed oil*. The movement was only fair, but the price was well maintained at \$1.53 per gal. in single-drum lots.

Advancing Market for Steel Products

Tendencies That Became Evident in January Have Resulted in Numerous Price Advances

PITTSBURGH, Feb. 16, 1923.

Many sellers of steel liken present conditions in the steel industry to those obtaining in 1920, on the eve of an enormous advance in steel prices for early delivery. In that period the mills received a great deal of money, but afterward, with various losses and adjustments, it was found that they had retained very little. Accordingly the mills profess anxiety to avoid a repetition of the 1920 performance. Possibly there is an ambition, however, to repeat in a more moderate way the price advances but avoid entirely the subsequent losses.

Thus far, at any rate, steel prices have not been pegged, the market showing fully as much advancing tendency as in the past 3 or 4 weeks, and more advancing tendency than in the first 2 or 3 weeks of January.

Numerous Price Advances

Bars, shapes and plates, quotable for 2 or 3 weeks past at a range of 2.10@2.20c., are now practically at 2.20c. as minimum, with the usual exception of large lots for late delivery against construction jobs.

While most of the independent sheet mills remain out of the market, refusing to commit themselves on second quarter business, there is enough buying and selling to indicate that the market is likely to be established at advances of \$4 to \$7 a ton over prices lately ruling and at which the Steel Corporation has sold for second quarter, these prices being 2.50c. for blue annealed, 3.35c. for black and 4.35c. for galvanized. The spread between black

and galvanized may increase from the recent 1c. to 1.15c.

The American Steel & Wire Co. has advanced its prices on nails and plain wire \$2 a ton, this being its first advance of the year on nails and its second on wire. Independents had previously been obtaining the higher prices. The market is now at 2.65c. for plain wire and \$2.80 for nails. Barb wire has also been advanced, also woven wire fence, the discount on which is now 69 per cent, in carload lots to jobbers.

Hoops and bands have been stiffening, the base price on heavy material advancing from 2.75c. to 2.90c., while light material, under 20 gage or 1-in. width, is 3.25@3.50c., base, against 3@3.25c. recently.

Semi-Finished Steel Higher

Recent transactions in billets, slabs and sheet bars appear to have cleaned up all steel available at the old price of \$38.50, and while recently some mills have been naming \$40 as their objective it seems doubtful now whether any steel could be bought at that figure. One seller of a large tonnage has had trouble in making scheduled deliveries and has been endeavoring to buy from other producers to apply on his obligation. The market in December was \$36.50, first quarter contracts being chiefly at that figure.

Latest developments suggest that possibly the decline in Connellsville coke is over, without prices reaching as low a level as expected. The theory has been that with the ending of winter the disappearance of buying for domestic consumption would cause further declines, but the new outlook is that increased consumptive demand will take up the expected slack. The change in basic conditions has been very decided. Not more than 2 months ago many steel producers were willing if not anxious to sell basic pig iron, as with their byproduct coke they could make it cheaper than merchant furnaces. The Republic Iron & Steel Co. was one of these, but now Republic has decided to blow in its Hannah furnace, a sort of reserve stack, and has bought coke, 500 tons a day to July 1, to take care of the stack, the company's byproduct coke covering only the Haselton stacks. The price paid is reported to be \$6.75. The market for spot furnace coke has declined 50c. in the week, being now quotable at \$7@7.25. This makes a total decline of \$2 since the end of December, but leaves the market 50c. higher than early in December, before the advance caused by buying of coke for domestic use.

Pig iron, expected by the majority of consumers for some time past to decline, now seems more likely to advance. Consumers must buy very soon now and an advance may easily be precipitated. The market is, indeed, a trifle stronger on the whole this week, as a result of a few transactions. Bessemer, formerly quotable at \$27.50@28 valley, is now firm at \$28 as minimum, while basic, quotable lately at \$25@26 valley, is now well established at \$26. Foundry remains at \$27@28. Freight to Pittsburgh is \$1.77.

Current Prices in the New York Market

FOR CHEMICALS, OILS AND ALLIED PRODUCTS

Although these prices are for the spot market in New York City, a special effort has been made to report the American manufacturer's quotations whenever available. In many instances these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported and resale stocks are reported when of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals			Formaldehyde, 40%, bbl.			Sulphur, roll, bbl.		
Acetic anhydride, 85%, drums	lb.	\$0.36 - \$0.38	Fullers earth, f.o.b. mines	net ton	\$0.151 - \$0.161	Talc—imported, bags	ton	\$2.00 - \$2.50
Acetone, drums	lb.	.21 - .21	Fullers earth—imp., powd., net	ton	30.00 - 32.00	Talc—domestic powd., bags	ton	18.00 - 25.00
Acid, acetic, 28%, bbl.	100 lb.	3.15 - 3.40	Fusel oil, ref., drums	gal.	3.55 - 4.05	Tin bichloride, bbl.	lb.	.11 - .11
Acetic, 56%, bbl.	100 lb.	6.25 - 6.50	Fusel oil, crude, drums	gal.	2.30 - 2.40	Tin oxide, bbl.	lb.	.47 - .48
Glacial, 99% carboys	100 lb.	12.00 - 12.50	Glaucous salt, wks., bags	100 lb.	1.20 - 1.40	Zinc carbonate, bags	lb.	.14 - .14
Boric, crystals, bbl.	lb.	.11 - .11	Glaucous salt, imp., bags	100 lb.	1.00 - 1.25	Zinc chloride, gran, bbl.	lb.	.06 - .07
Boric, powder, bbl.	lb.	.11 - .11	Glycerine, c.p., drums extra	lb.	.18 - .19	Zinc cyanide, drums	lb.	.37 - .38
Citric, kegs	lb.	.49 - .50	Glycerine, dynamite, drums	lb.	.17 - .17	Zinc oxide, XX, bbl.	lb.	.07 - .08
Formic, 85%	lb.	.15 - .17	Iodine, resublimed	lb.	4.40 - 4.50	Zinc sulphate, bbl.	100 lb.	2.75 - 3.00
Gallio, tech.	lb.	.45 - .50	Iron oxide, red, casks	lb.	.12 - .18			
Hydrochloric, 18% tanks	100 lb.	.90 - 1.00	Lead:					
Hydrofluoric, 52%, carboys	lb.	.12 - .12	White, basic carbonate, dry,					
Lactic, 44%, tech., light,	lb.	.11 - .11	casks	lb.	.09 - .10			
22% tech., light, bbl.	lb.	.05 - .05	White, in oil, kegs	lb.	.12 - .13			
Muriatic, 20% tanks	100 lb.	1.00 - 1.10	Red, dry, casks	lb.	.11 - .11			
Nitric, 36%, carboys	lb.	.04 - .05	Red, in oil, kegs	lb.	.13 - .14			
Nitric, 42%, carboys	lb.	.06 - .06	Lead acetate, white crys.	bbl.	.13 - .13			
Oleum, 20% tanks	ton	17.00 - 18.00	Lead arsenate, powd., bbl.	lb.	.23 - .24			
Oxalic, crystals, bbl.	lb.	.12 - .13	Lime-Hydrated, bbl.	per ton	16.80 - 17.00			
Phosphoric, 50% carboys	lb.	.08 - .09	Lime, Lump, bbl.	280 lb.	3.63 - 3.65			
Pyrogallol, resublimed	lb.	1.50 - 1.60	Litharge, comm., casks	lb.	.10 - .10			
Sulphuric, 60% tanks	ton	9.00 - 10.00	Lithopone, bbl.	lb.	.06 - .07			
Sulphuric, 60% drums	ton	12.00 - 14.00	Magnesium carb. tech., bags	lb.	.08 - .08			
Sulphuric, 66% tanks	ton	14.50 - 15.00	Methanol, 95% bbl.	gal.	1.23 - 1.25			
Sulphuric, 66% drums	ton	19.00 - 20.00	Methanol, 97% bbl.	gal.	1.25 - 1.27			
Tannic, U.S.P., bbl.	lb.	.65 - .70	Nickel salt, double, bbl.	lb.	.10 - .10			
Tannic, tech., bbl.	lb.	.40 - .45	Nickel salts, single, bbl.	lb.	.11 - .11			
Tartaric, imp. crys., bbl.	lb.	.30 - .31	Phosgene	lb.	.60 - .75			
Tartaric, imp. powd., bbl.	lb.	.31 - .32	Phosphorus, red, cases	lb.	.35 - .40			
Tartaric, domestic, bbl.	lb.	.32 - .32	Phosphorus, yellow, cases	lb.	.30 - .35			
Tungstic, per lb. of WO ₃	lb.	1.00 - 1.20	Potassium bichromate, casks	lb.	.09 - .10			
Alcohol, butyl, drums	gal.	.18 - .23	Potassium bromide, gran.,	lb.	.16 - .23			
Alcohol ethyl (Cologne	gal.	4.75 - 4.95	bbl.					
Alcohol, methyl (see Methanol)			Potassium carbonate, 80-85%	lb.	.05 - .06			
Alcohol, denatured, 188 proof			calcined, casks	lb.	.07 - .08			
No. 1	gal.	.38 - .40	Potassium chlorate, powd.	lb.	.04 - .05			
Alum, ammonia, lump, bbl.	lb.	.03 - .03	Potassium cyanide, drums	lb.	.45 - .50			
Potash, lump, bbl.	lb.	.03 - .03	Potassium hydroxide (caustic					
Chrome, lump, potash, bbl.	lb.	.05 - .05	potash) drums	100 lb.	7.25 - 7.50			
Aluminum sulphate, com.	100 lb.	1.50 - 1.65	Potassium iodide, cases	lb.	3.50 - 3.60			
Iron free bags	lb.	.02 - .02	Potassium nitrate, bbl.	lb.	.06 - .07			
Aqua ammonia, 26% drums	lb.	.06 - .07	Potassium permanganate,	lb.	.18 - .19			
Ammonia, anhydrous, cyl.	lb.	.30 - .30	drums					
Ammonium carbonate, powd.	lb.	.09 - .10	Potassium prussiate, red,	lb.	.85 - .90			
caustic, imported	lb.	.09 - .10	casks					
Ammonium carbonate, powd.	lb.	.13 - .14	Potassium prussiate, yellow,	lb.	.38 - .39			
domestic, bbl.	lb.	.13 - .14	casks					
Ammonium nitrate tech.,	lb.	.10 - .11	Salammoniac, white, gran.,	lb.	.06 - .06			
casks	lb.	.10 - .11	caustic, imported	lb.	.06 - .06			
Rosale drums	100 lb.	2.80 - 3.05	Salammoniac, white, gran.,	lb.	.08 - .08			
Borax, bbl.	lb.	.05 - .05	bbl., domestic	lb.	.08 - .08			
Bromine, cases	lb.	.25 - .27	Gray, gran., casks	lb.	.08 - .08			
Calcium acetate, bags	100 lb.	3.50 - 3.60	Salsoda, bbl.	100 lb.	1.20 - 1.40			
Calcium carbide, drums	lb.	.04 - .04	Salt cake (bulk)	ton	26.00 - 28.00			
Calcium chloride, fused, drums	ton	22.00 - 23.00	Soda ash, light, 50% flat,	100 lb.	1.60 - 1.67			
Gran. drums	lb.	.01 - .01	bags, contract	100 lb.	1.20 - 1.30			
Calcium phosphate, mono,	lb.	.06 - .07	Soda ash, light, basic, 48%,	100 lb.	1.20 - 1.30			
bbl.	lb.	.06 - .07	bags, contract, f.o.b.	100 lb.	1.20 - 1.30			
Camphor, cases	lb.	.91 - .93	wks.	100 lb.	1.20 - 1.30			
Carbon bisulphide, drums	lb.	.07 - .07	Soda ash, light, 50% flat,	100 lb.	1.20 - 1.30			
Carbon tetrachloride, drums	lb.	.09 - .10	bags, resale	100 lb.	1.25 - 1.80			
Chalk, precip.—domestic,	lb.	.04 - .04	Soda ash, dense, bags, con-	100 lb.	1.17 - 1.20			
light, bbl.	lb.	.04 - .04	tract, basis 48%	100 lb.	1.17 - 1.20			
Domestic, heavy, bbl.	lb.	.04 - .05	Soda ash, dense, in bags,	100 lb.	1.85 - 1.90			
Imported, light, bbl.	lb.	.06 - .06	resale	100 lb.	1.85 - 1.90			
Chlorine, liquid, cylinders	lb.	.35 - .38	Soda, caustic, 76% solid,	100 lb.	3.45 - 3.70			
Chloroform, tech., drums	lb.	2.10 - 2.25	drums, f.a.s.	100 lb.	3.45 - 3.70			
Cobalt oxide, bbl.	ton	16.50 - 20.00	Soda, caustic, 76% solid,	100 lb.	3.35 - 3.40			
Copperas, bulk, f.o.b. wks.	ton	.19 - .20	drums, contract	100 lb.	2.50 - 2.60			
Copper carbonate, bbl.	lb.	.47 - .50	Soda, caustic, basis 60%	100 lb.	2.50 - 2.60			
Copper cyanide, drums	lb.	6.00 - 6.25	wks., contract	100 lb.	3.80 - 3.90			
Coppersulphate, crys., bbl.	100 lb.	6.00 - 6.25	Soda, caustic, ground and	100 lb.	4.00 - 4.15			
Cream of tartar, bbl.	lb.	.24 - .25	flake, contracts	100 lb.	.06 - .06			
Dextrine, corn, bags	100 lb.	3.25 - 3.50	flake, resale	100 lb.	1.75 - 1.85			
Epsom salt, dom., tech.	100 lb.	2.10 - 2.25	Sodium acetate, works, bags	lb.	.07 - .08			
bbl.	100 lb.	1.10 - 1.25	Sodium bicarbonate, bbl.	100 lb.	6.00 - 7.00			
Epsom salt, U.S.P., dom.	100 lb.	2.50 - 2.75	Sodium bichromate, casks	lb.	.04 - .04			
bbl.	100 lb.	.13 - .15	Sodium bisulphate (niter cake)	ton	.06 - .07			
Ether, U.S.P., drums	lb.	.80 - .85	Sodium bisulphate, powd.,	lb.	.04 - .04			
Ethyl acetate, com., 85%	gal.	.95 - 1.00	U.S.P., bbl.	lb.	.04 - .04			
ether, 98% to 100%	gal.	.95 - 1.00	Sodium chloride, kegs	long ton	12.00 - 13.00			
			Sodium chloride, cases	lb.	.20 - .23			
			Sodium fluoride, bbl.	lb.	.09 - .10			
			Sodium hypsulphite, bbl.	lb.	.03 - .03			
			Sodium nitrite, casks	lb.	.08 - .09			
			Sodium peroxide, powd., cases	lb.	.28 - .30			
			Sodium phosphate, dibasic,	lb.	.03 - .04			
			bbl.	lb.	.19 - .20			
			Sodium prussiate, yel. drums	100 lb.	.80 - 1.15			
			Sodium silicate (40% drums)	100 lb.	2.00 - 2.25			
			Sodium silicate (60% drums)	100 lb.	.04 - .04			
			Sodium sulphide, fused, 60-	lb.	.03 - .03			
			62% drums	lb.	.09 - .09			
			Sodium sulphite, crys., bbl.	lb.	.03 - .03			
			Strontium nitrate, powd., bbl.	lb.	.04 - .05			
			Sulphur chloride, yel. drums	ton	18.00 - 20.00			
			Sulphur, crude	lb.	.08 - .08			
			Sulphur dioxide, liquid, cyl.	100 lb.	2.35 - 3.15			
			Sulphur, flour, bbl.	100 lb.				

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	\$0.80 - \$0.85
Alpha-naphthol, ref., bbl.	lb.	1.05 - 1.10
Alpha-naphthylamine, bbl.	lb.	.27 - .30
Aniline oil, drums	lb.	.16 - .17
Aniline salts, bbl.	lb.	.24 - .25
Anthracene, 80%, drums	lb.	.75 - 1.00
Anthracene, 80%, imp.	lb.	.65 - .70
Anthraquinone, 25%, paste,	lb.	.70 - .75
drums	lb.	1.40 - 1.45
Benzaldehyde U.S.P., carboys	lb.	.30 - .35
Benzene, pure, water-white,	gal.	.26 - .32
tanks and drums	gal.	.32 - .34
Benzene, 90%, tanks & drums	gal.	.85 - .90
Benzene, 90%, drums, resale	gal.	.75 - .80
Benzidine base, bbl.	lb.	.72 - .75
Benzidine sulphate, bbl.	lb.	.57 - .65
Benzoic acid, U.S.P., kegs	lb.	.25 - .27
Benzoate of soda, U.S.P., bbl.	lb.	.20 - .23
Benzyl chloride, 95-97%, ref.	lb.	.55 - .60
drums	lb.	.24 - .25
Benzyl chloride, tech., drums	lb.	1.00 - 1.25
Beta-naphthol, sublim., bbl.	lb.	.75 - .90
Beta-naphthol, tech., bbl.	lb.	.25 - .27
Beta-naphthylamine, tech.	lb.	.24 - .26
Carbasol, bbl.	lb.	1.50 - 1.75
Cresol, U.S.P., drums	gal.	1.50 - 1.75
Ortho-cresol, drums	gal.	.07 - .09
Cresylic acid, 97%, resale,	gal.	.50 - .60
drums	lb.	.41 - .42
95-97%, drums, resale	lb.	.20 - .22
Dichlorobenzene, drums	lb.	.22 - .23
Diethylaniline, drums	lb.	.30 - .32
Dimethylaniline, drums	lb.	.35 - .40
Dinitrobenzene, bbl.	lb.	.22 - .24
Dinitrochlorobenzene, bbl.	lb.	.22 - .24
Dinitronaphthalene, bbl.	lb.	.22 - .24
Dinitrophenol, bbl.	lb.	.22 - .24
Dinitrotoluene, bbl.	lb.	.22 - .24
Dip oil, 25%, drums	gal.	.25 - .30
Diphenylamine, bbl.	lb.	.53 - .55
H-acid, bbl.	lb.	.80 - .85
Meta-phenylenediamine, bbl.	lb.	.95 - 1.00
Miehlers ketone, bbl.	lb.	3.00 - 3.50
Monochlorobenzene, drums	lb.	.08 - .10
Monochlorobenzene, drums	lb.	.95 - 1.10
Monochlorobenzene, drums	lb.	.05 - .06
Naphthalene, crushed, bbl.	lb.	.06 - .06
Naphthalene, flake, bbl.	lb.	.07 - .07
Naphthalene, balls, bbl.	lb.	.58 - .65
Naphthalene of soda, bbl.	lb.	.60 - .65
Naphthionic acid, crude, bbl.	lb.	.10 - .12
Nitrobenzene, drums	lb.	.30 - .35
Nitro-naphthalene, bbl.	lb.	.15 - .17
Nitro-toluene, drums	lb.	1.15 - 1.20
N-W acid, bbl.	lb.	2.30 - 2.35
Ortho-amidophenol, kegs	lb.	.17 - .20
Ortho-dichlorobenzene, drums	lb.	.90 - .92
Ortho-nitrophenol, bbl.	lb.	.10 - .12
Ortho-nitrotoluene, drums	lb.	.13 - .15
Ortho-toluidine, bbl.	lb.	1.15 - 1.20
Para-amidophenol, base, kegs	lb.	1.20 - 1.25
Para-amidophenol, HCl, kegs	lb.	.17 - .20
Para-dichlorobenzene, bbl.	lb.	.74 - .75
Paranitraniline, bbl.	lb.	.55 - .65
Para-nitrotoluene, bbl.	lb.	1.50 - 1.55
Para-phenylenediamine, bbl.	lb.	.85 - .90
Para-toluidine, bbl.	lb.	.35 - .38
Phthalic anhydride, bbl.	lb.	.35 - .37
Phenol, U.S.P., drums	lb.	.20 - .22
Pieric acid, bbl.	lb.	nominal
Pyridine, dom., drums	gal.	2.75 - 3.00
Pyridine, imp., drums	gal.	1.50 - 1.55
Resorcinol, tech., kegs	lb.	2.00 - 2.10
Resorcinol, pure, kegs	lb.	.55 - .60
R-salt, bbl.	lb.	.40 - .42
Salicylic acid, tech., bbl.	lb.	.45 - .47
Salicylic acid, U.S.P., bbl.	lb.	
Solvent naphtha, water-	gal.	.37 - .40
white, drums	gal.	.22 - .24
Crude, drums	lb.	.18 - .20
Sulphanilic acid, crude, bbl.	lb.	.35 - .38
Thiocarbonyl chloride, kegs	lb.	1.20 - 1.30
Toluidine, kegs	lb.	.30 - .35
Toluidine, mixed, kegs	gal.	.35 - .37
Toluene, tank cars	gal.	.40 - .43
Toluene, drums	lb.	.40 - .45
Xylidines, drums	gal.	.45 - .50
Xylene, pure, drums	gal.	.40 - .42
Xylene, com., drums	gal.	.30 - .35
Xylene, com., tanks	gal.	

Naval Stores

Rosin B-D, bbl.	280 lb.	\$6.25	-
Rosin E-I, bbl.	280 lb.	6.25	- \$6.40
Rosin K-N, bbl.	280 lb.	6.55	- 6.90
Rosin W-G-W.W., bbl.	280 lb.	7.40	- 8.10
Wood rosin, bbl.	280 lb.	6.25	-
Turpentine, spirits of, bbl.	gal.	1.50	- 1.51
Wood, steam dist., bbl.	gal.	1.35	-
Wood, dest. dist., bbl.	gal.	1.25	-
Pine tar pitch, bbl.	200 lb.	-	12.00
Tar, kiln burned, bbl.	500 lb.	-	11.00
Retort tar, bbl.	500 lb.	-	43
Rosin oil, first run, bbl.	gal.	47	-
Rosin oil, second run, bbl.	gal.	53	-
Rosin oil, third run, bbl.	gal.	-	90
Pine oil, steam dist., bbl.	gal.	-	85
Pine oil, pure, dest. dist., bbl.	gal.	-	46
Pine tar oil, ref., bbl.	gal.	-	35
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla., bbl.	gal.	-	75
Pine tar oil, double ref., bbl.	gal.	-	25
Pine tar, ref., thin, bbl.	gal.	-	52
Pine wood creosote, ref., bbl.	gal.	-	-

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	\$1.12	- \$1.13
Castor oil, AA, bbl.	lb.	1.13	- 1.13
Chinawood oil, bbl.	lb.	1.18	- 1.18
Cocunut oil, Ceylon, bbl.	lb.	0.91	- 0.91
Cocunut oil, Coochin, bbl.	lb.	0.91	- 0.91
Corn oil, crude, bbl.	lb.	1.11	- 1.11
Cottonseed oil, crude (f.o.b. mill), tanks.	lb.	0.91	- 1.10
Summer yellow, bbl.	lb.	1.12	- 1.12
Winter yellow, bbl.	lb.	1.13	- 1.13
Linseed oil, raw, car lots, bbl.	gal.	0.96	- 0.97
Raw, tank cars (dom.), bbl.	gal.	0.92	- 0.93
Boiled, 5-bbl. lots (dom.), bbl.	gal.	1.00	- 1.02
Olive oil, denatured, bbl.	gal.	1.00	- 1.15
Palm, Lagos, casks.	lb.	0.08	- 0.08
Palm kernel, bbl.	lb.	0.08	- 0.09
Peanut oil, crude, tanks (mill), bbl.	lb.	1.13	- 1.13
Peanut oil, refined, bbl.	lb.	1.16	- 1.16
Rapeseed oil, refined, bbl.	gal.	0.85	- 0.86
Rapeseed oil, blown, bbl.	gal.	0.90	- 0.91
Soya bean (Manchurian), bbl.	lb.	1.11	- 1.11
Tank, f.o.b. Pacific coast.	lb.	1.10	- 1.10

Fish Oils

Menhaden, light pressed, bbl.	gal.	\$0.60	-
White bleached, bbl.	gal.	0.64	- 0.65
Blown, bbl.	gal.	0.68	- 0.69
Whale No. 1 crude, tanks, coast.	lb.	0.06	- 0.06

Dye & Tanning Materials

Divi-divi, bags.	ton	\$38.00	- \$39.00
Fustic, sticks.	ton	30.00	- 35.00
Fustic, chips, bags.	lb.	0.04	- 0.05
Logwood, sticks.	ton	28.00	- 30.00
Logwood, chips, bags.	lb.	0.02	- 0.03
Sumac, leaves, Sicily, bags.	ton	65.00	-
Sumac, ground, bags.	ton	55.00	- 60.00
Sumac, domestic, bags.	ton	35.00	-
Tapioca flour, bags.	ton	0.03	- 0.05

EXTRACTS

Archil, conc., bbl.	lb.	\$0.17	- \$0.18
Chestnut, 25% tannin, tanks.	lb.	0.02	- 0.03
Divi-divi, 25% tannin, bbl.	lb.	0.04	- 0.05
Fustic, crystals, bbl.	lb.	20	- 22
Fustic, liquid, 42% bbl.	lb.	0.08	- 0.09
Gambier, liq., 25% tannin, bbl.	lb.	0.08	- 0.09
Hematin crys., bbl.	lb.	14	- 18
Hemlock, 25% tannin, bbl.	lb.	0.04	- 0.05
Hypernic, solid, drums.	lb.	24	- 26
Hypernic, liquid, 51% bbl.	lb.	14	- 17
Logwood, crys., bbl.	lb.	19	- 20
Logwood, liq., 51% bbl.	lb.	0.09	- 0.10
Quebracho, solid, 65% tannin, bbl.	lb.	0.04	- 0.05
Sumac, dom., 51% bbl.	lb.	0.06	- 0.07

Waxes

Bayberry, bbl.	lb.	\$0.28	- \$0.30
Beeswax, refined, dark, bags.	lb.	30	- 32
Beeswax, refined, light, bags.	lb.	34	- 35
Beeswax, pure white, cases.	lb.	40	- 41
Candelilla, bags.	lb.	33	- 34
Carnauba, No. 1, bags.	lb.	38	- 40
No. 2, North Country, bags.	lb.	24	- 24
No. 3, North Country, bags.	lb.	17	- 18
Japan, cases.	lb.	15	- 15
Montan, crude, bags.	lb.	0.03	- 0.04
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	0.04	- 0.04
Crude, scale 124-126 m.p., bags.	lb.	0.02	- 0.02
Ref., 118-120 m.p., bags.	lb.	0.03	- 0.03
Ref., 125 m.p., bags.	lb.	0.03	- 0.03
Ref., 128-130 m.p., bags.	lb.	0.04	- 0.04
Ref., 133-135 m.p., bags.	lb.	0.04	- 0.04
Ref., 135-137 m.p., bags.	lb.	0.05	- 0.05
Stearic acid, agle pressed, bags.	lb.	10	- 10
Double pressed, bags.	lb.	10	- 10
Triple pressed, bags.	lb.	11	- 11

Fertilizers

Ammonium sulphate, bulk, f.o.b. works.	100 lb.	\$3.20	- \$3.25
F.a.s. double bags.	100 lb.	3.85	- 3.95
Blood, dried, bulk.	unit	4.60	-
Bone, raw, 3 and 50, ground.	ton	30.00	- 35.00
Fish scrap, dom., dried, wks.	unit	5.00	- 5.10
Nitrate of soda, bags.	100 lb.	2.60	- 2.65
Tankage, high grade, f.o.b. Chicago.	unit	4.70	- 4.80

Phosphate rock, f.o.b. mines, Florida pebble, 68-72%.	ton	\$3.50	- \$4.00
Tennessee, 75-80%.	ton	7.00	- 8.00
Potassium murate, 80%, bags.	ton	35.00	- 36.00
Potassium sulphate, bags.	unit	1.00	-

Crude Rubber

Para-Upriver fine.	lb.	\$0.33	- \$0.33
Upriver coarse.	lb.	0.27	- 0.27
Upriver cauchoball.	lb.	0.24	- 0.29
Plantation—First latex crepe.	lb.	0.35	- 0.35
Ribbed smoked sheets.	lb.	0.35	- 0.35
Brown crepe, thin.	lb.	0.31	- 0.32
clean.	lb.	0.31	- 0.32
Amber crepe No. 1.	lb.	0.31	- 0.32

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec.	sh. ton	\$450.00	- \$550.00
Asbestos, shingle, f.o.b., Quebec.	sh. ton	60.00	- 80.00
Asbestos, cement, f.o.b., Quebec.	sh. ton	15.00	- 17.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	16.00	- 20.00
Barytes, grd., off-color, f.o.b. mills bulk.	net ton	13.00	- 21.00
Barytes, floated, f.o.b. St. Louis, bbl.	net ton	24.00	- 28.00
Barytes, crude f.o.b. mines, bulk.	net ton	8.50	- 9.00
Casein, bbl., tech.	lb.	11	- 12
China clay (kaolin) crude, f.o.b. Ga.	net ton	7.00	- 9.00
Waahed, f.o.b. Ga.	net ton	8.00	- 9.00
Powd., f.o.b. Ga.	net ton	13.00	- 20.00
Crude f.o.b. Va.	net ton	8.00	- 12.00
Ground, f.o.b. Va.	net ton	13.00	- 20.00
Imp., lump, bulk.	net ton	15.00	- 20.00
Imp., powd.	net ton	45.00	- 50.00
Feldspar, No. 1 pottery.	long ton	6.00	- 7.00
No. 2 pottery.	long ton	5.00	- 5.50
No. 1 soap.	long ton	7.00	- 7.50
No. 1 Canadian, f.o.b. mill.	long ton	25.00	- 27.00
Graphite, Ceylon, lump, first quality, bbl.	lb.	0.06	- 0.06
Ceylon, chip, bbl.	lb.	0.05	- 0.05
High grade amorphous crude.	ton	35.00	- 50.00
Gum arabic, amber, sorts.	lb.	15	- 16
Gum tragacanth, sorts, bags.	lb.	50	- 60
No. 1, bags.	lb.	1.75	- 1.80
Kieselguhr, f.o.b. Cal.	ton	40.00	- 42.00
F.o.b. N. Y.	ton	50.00	- 55.00
Magnesite, crude, f.o.b. Cal.	ton	14.00	- 15.00
Pumice stone, imp., casks.	lb.	0.03	- 0.05
Dom., lump, bbl.	lb.	0.05	- 0.07
Dom., ground, bbl.	lb.	0.06	- 0.07
Shellac, orange fine, bags.	lb.	0.82	- 0.83
Orange superfine, bags.	lb.	0.79	- 0.80
A. C. garnet, bags.	lb.	0.80	- 0.81
T. N., bags.	lb.	0.80	- 0.81
Silica, glass sand, f.o.b. Ind.	ton	2.00	- 2.50
Silica, sand blast, f.o.b. Ind.	ton	2.50	- 5.00
Silica, amorphous, 250-mesh, f.o.b. Ill.	ton	17.00	- 17.50
Silica, bldg. sand, f.o.b. Pa.	ton	2.00	- 2.75
Soapstone, coarse, f.o.b. Vt.	ton	7.00	- 8.00
Talc, 200 mesh, f.o.b. Vt., bags.	ton	6.50	- 9.00
Talc, 200 mesh, f.o.b. Ga., bags.	ton	7.00	- 9.00
Talc, 200 mesh, f.o.b. Los Angeles, bags.	ton	16.00	- 20.00

Refractories

Bauxite brick, 56% Al ₂ O ₃ , f.o.b. Pittsburgh.	ton	\$45-50	
Chrome brick, f.o.b. Eastern shipping points.	ton	50-52	
Chrome cement, 40-50% Cr ₂ O ₃ , 40-45% Cr ₂ O ₃ , sacks, f.o.b. Eastern shipping points.	ton	23-27	
Fireclay brick, 1st quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	40-46	
2nd quality, 9-in. shapes, f.o.b. wks.	1,000	36-41	
Magnesite brick, 9-in. straight (f.o.b. wks.).	ton	65-68	
9-in. arches, wedges and keys.	ton	80-85	
Scraps and splits.	ton	85	
Silica brick, 9-in. sizes, f.o.b. Chicago district.	1,000	48-50	
Silica brick, 9-in. sizes, f.o.b. Birmingham district.	1,000	48-50	
F.o.b. Mt. Union, Pa.	1,000	42-44	
Silicon carbide refract. brick, 9-in.	1,000	1,100.00	

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N. Y.	ton	\$200.00	- \$225.00
Ferrocromium, per lb. of Cr, 6-8% C.	lb.	0.11	- 0.11
4-6% C.	lb.	0.12	- 0.13
Ferromanganese, 78-82% Mn, Atlantic seab. duty paid.	gr. ton	105.00	- 107.50
Spiegelisen, 19-21% Mn.	gr. ton	35.00	- 37.00
Ferromolybdenum, 50-60% Mo, per lb. Mo.	lb.	1.90	- 2.15
Ferrosilicon, 10-15% Si.	gr. ton	38.00	- 40.00
50%.	gr. ton	80.00	- 85.00
75%.	gr. ton	150.00	- 160.00

Ferrotungsten, 70-80%, per lb. of W.	lb.	\$0.90	- \$0.95
Ferro-uranium, 35-50% of U, per lb. of U.	lb.	6.00	-
Ferrovanadium, 30-40%, per lb. of V.	lb.	3.50	- 4.00

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points.	ton	\$6.50	- \$8.75
Chrome ore, Calif. concentrates, 50% min. Cr ₂ O ₃ .	ton	22.00	- 23.00
C.i.f. Atlantic seaboard.	ton	18.50	- 19.00
Coke, fdry., f.o.b. ovens.	ton	8.00	- 8.50
Coke, furnace, f.o.b. ovens.	ton	7.00	- 7.50
Fluorspar, gravel, f.o.b. mines, New Mexico.	ton	17.50	-
Fluorspar, No. 2 Lump—Ky. & Ill. mines.	ton	25.00	-
Ilmenite, 52% TiO ₂ .	lb.	0.01	- 0.01
Manganese ore, 50% Mn, c.i.f. Atlantic seaboard.	unit	0.33	-
Manganese ore, chemical (MnO ₂).	ton	75.00	- 80.00
Molybdenite, 85% MoS ₂ , per lb. MoS ₂ , N. Y.	lb.	0.65	- 0.70
Monazite, per unit of ThO ₂ , c.i.f. Atl. seaboard.	lb.	0.06	- 0.08
Pyrites, Span., fines, c.i.f. Atl. seaboard.	unit	0.11	- 0.12
Pyrites, Span., furnace size, c.i.f. Atl. seaboard.	unit	0.11	- 0.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	0.12	-
Rutile, 95% TiO ₂ .	lb.	0.12	-
Tungsten, scheelite, 60% WO ₃ and over, per unit.	unit	8.00	- 8.50
Tungsten, wolframite, 60% WO ₃ and over, per unit.	unit	7.50	- 8.00
Uranium ore (carnotite) per lb. of U ₃ O ₈ .	lb.	3.50	- 3.75
Uranium oxide, 96% per lb. U ₃ O ₈ .	lb.	2.25	- 2.50
Vanadium pentoxide, 99%.	lb.	12.00	- 14.00
Vanadium ore, per lb. V ₂ O ₅ .	lb.	1.00	-
Zircon, washed, iron free, f.o.b. Pablo, Fla.	lb.	0.04	- 0.13

Non-Ferrous Materials

	Cents per Lb.
Copper, electrolytic.	13.25
Aluminum, 98 to 99%.	23.00
Antimony, wholesale, Chinese and Japanese.	7.15-7.50
Nickel, virgin metal.	25.00-27.00
Nickel, ingot and shot.	29.00
Monel metal, shot and blocks.	32.00
Monel metal, ingots.	38.00
Monel metal, sheet bars.	45.00
Tin, 5-ton lots, Straits.	41.00
Lead, New York, spot.	8.05
Lead, E. St. Louis, spot.	8.00-8.15
Zinc, spot, New York.	7.35-7.45
Zinc, spot, E. St. Louis.	6.95-7.15

OTHER METALS

Silver (commercial).	os.	\$0.64
Cadmium.	lb.	1.15
Bismuth (500 lb. lots).	lb.	2.55
Cobalt.	lb.	3.00@3.25
Magnesium, ingots, 99%.	lb.	1.00@1.05
Platinum.	os.	116.00
Iridium.	os.	260.00@275.00
Palladium.	os.	79.00
Mercury.	75 lb.	71.00

FINISHED METAL PRODUCTS

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled.	20.75
Copper bottoms.	30.75
Copper rods.	20.50
High brass wire.	19.50
High brass rods.	17.00
Low brass wire.	21.10
Low brass rods.	22.00
Brazed brass tubing.	24.25
Brazed bronze tubing.	29.00
Seamless copper tubing.	25.25
Seamless high brass tubing.	23.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible.	11.30@11.50
Copper, heavy and wire.	11.25@11.50
Copper, light and bottoms.	9.25@9.50
Lead, heavy.	5.75@6.00
Lead, tea.	3.50@3.75
Brass, heavy.	6.25@6.40
Brass, light.	5.35@5.75
No. 1 yellow brass turnings.	6.30@6.50
Zinc.	3.50@4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by 1/2 in. and larger, and plates 1/2 in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes.	\$3.29	\$3.14
Soft steel bars.	3.19	3.04
Soft steel bar shapes.	3.19	3.04
Soft steel bands.	3.29	3.19
Plates, 1/2 to 1 in. thick.	3.29	3.14

Industrial

Financial, Construction and Manufacturers' News

Industrial Developments

CEMENT—The Petoskey Portland Cement Co., Petoskey, Mich., is operating at full capacity with regular working force. It is proposed to create all possible reserves for spring distribution, totaling approximately 250,000 bbl., as now estimated.

Cement mills in the vicinity of Nazareth, Pa., are running at maximum and have sufficient orders on hand to continue on this basis until well into next fall.

The Bessemer Limestone & Cement Co., Bessemer, Pa., is planning for the early resumption of activities at its cement mill, closed down on Feb. 1 for necessary machinery repairs. The plant was completed a little over a year ago and has been in steady operation since that time. It is proposed to perfect arrangements for increased production.

All cement mills in the vicinity of Copley, Pa., are running full, and purpose to maintain this basis of production for an indefinite period.

CERAMIC—The O. Zimbal Brick Co., Sheboygan, Wis., is perfecting plans for immediate increased production at its plant.

The Southern Brick & Tile Co., Louisville, Ky., has resumed production at its plant after a brief curtailment. It is planned to develop maximum output at an early date.

The Coral Ridge Clay Products Co., Louisville, Ky., manufacturer of brick and tile products, is operating at full capacity, with output about equally divided between brick and tile. It is proposed to continue operations throughout the winter.

Sanitary ware plants at Philadelphia, Pa., and vicinity are running on a curtailed schedule owing to the unsettled strike of the operative sanitary potters. A number of potteries are breaking in new men and expect to advance production at an early date.

The Tri-City Brick Co., Carbon Cliff, Ill., is operating at full capacity and has plans maturing for extensions to provide for early increase in output. Additions will be made in the working force.

LEATHER—The Griess-Pfleger Tanning Co., Waukegan, Ill., is running under good capacity at its local tannery, producing calfskins, splits and kindred specialties. The company also operates a tannery in Chicago, and is maintaining regular production at this point.

The Mississippi Valley Tanning Co., St. Louis, Mo., is maintaining regular production at its local tannery, giving employment to a normal working force. Operations are devoted to black glazed kid.

OIL—The Sinclair Oil Corp., New York, is pushing construction on its new oil refinery at Trainer, near Marcus Hook, Pa., and the present building force of 500 men will be increased to 1,000 men at an early date. Foundations are being laid for 24 stills, each with capacity of 1,000 bbl. When completed, the plant will give employment to approximately 600 workers, and will represent an investment of close to \$4,000,000.

The American Cotton Oil Co., 65 Broadway, New York, has closed a number of its cottonseed crushing mills for the season. Several plants will remain shut down permanently, while operations at the others will be resumed as soon as conditions warrant. The company expects to maintain its cottonseed oil business at the present status, with possible increase in the future; it will not abandon this branch of operation, as currently reported.

The Producers' & Refiners' Corp., California Bldg., Denver, Colo., is planning for an early increase in production at its refining plants in Wyoming, advancing from 10,000 to 15,000 bbl. per day. Before the close of the year, it is expected to develop a capacity of 20,000 bbl. per day.

Employees of the Vacuum Oil Co., Bayonne, N. J., have asked an increase in wages aggregating 12 per cent. The request

will be considered at an early meeting of the board of directors. Employment is now being given to about 600 operatives.

Workers at the refining plant of the Tidewater Oil Co., Bayonne, N. J., has been granted a wage advance of about 2 per cent. The men recently asked for an increase approximating 12 per cent. About 2,000 employees are affected.

PAPER—The Fort William Paper Co., Ltd., Fort William, Ont., is planning for an early increase in production at its new newsprint mill, recently placed in service. The present output approximates 75 tons daily and this will be advanced to a continuous run of 150 tons per day some time in March.

The Plainfield Paper Co., recently organized to take over and succeed the Childs Paper Co., Childs, near Rockford, Mich., is planning for early operations at the local mill, giving employment to a regular working force. Burke M. Baxter has been elected president.

The River Raisin Paper Co., Monroe, Mich., is operating on a full capacity schedule, giving employment to a regular working force, and expects to continue on this basis for an indefinite period. The bulk of production is devoted to corrugated and fiber paper specialties.

Paper mills in the state of Washington devoted to newsprint are all running at maximum production, with advance orders to insure the continuance of this schedule for more than 12 months to come.

IRON AND STEEL—The Alabama Co., Birmingham, Ala., is arranging for the immediate blowing in of its blast furnace at Gadsden, Ala., for pig-iron production.

The Penn-Seaboard Steel Corp., Philadelphia, Pa., is operating at about 55 per cent of normal plant capacity, and purposes to advance this schedule at an early date.

The Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., is completing repairs to its Oxmoor blast furnace, and plans to have the unit ready for service by the close of the month. The company is operating its four furnaces at Bessemer, Ala., for pig-iron production, while six furnaces at Ensley and one furnace at Birmingham are running on basic iron. The company is said to have heavy orders on hand.

The Youngstown Sheet & Tube Co., Youngstown, O., has blown in its second blast furnace at Hubbard, near Sharon, Pa.

The blast furnace at the lower works of the Glasgow Iron Co., Pottstown, Pa., idle for a number of years, has been sold to other interests and will be dismantled at an early date.

Eight of eleven furnaces at the Edgar Thomson Works of the Carnegie Steel Co., North Braddock, Pa., are now in operation. Furnace H, which has been idle since March, 1921, has just been blown in.

MISCELLANEOUS—The Interstate Glass Co., Huntington, W. Va., manufacturer of window glass, has resumed operations at its plant, after a shutdown for more than a year. It is expected to develop maximum capacity at an early date, giving employment to about 300 persons.

The Cadillac Lumber & Chemical Co., Sault Ste. Marie, Mich., is pushing construction on its new local plant and plans to inaugurate production late in April or early in May. Two more buildings will be erected and equipped.

Paint and varnish manufacturers in the Philadelphia, Pa., district are operating from 75 to 100 per cent capacity, with full working forces.

The International Nickel Co., New York, is operating in certain departments at its new plant at Huntington, W. Va., and expects to increase production gradually until the works are running full. The plant represents an investment of close to \$3,000,000.

The Tennessee Copper & Chemical Co., 61 Broadway, New York, is operating at full capacity at its new sulphate plant, and will continue on this basis for an indefinite period. It is said that the entire output for the present year has been sold.

Construction and Operation

Alabama

ANNISTON—The Independent Soil Pipe Co., has awarded a contract to the Ogletree Construction Co., Anniston, for the erection of a 1-story addition to its foundry, 70x108 ft., comprising the former works of the Ajax Foundry Co., lately acquired. It will be used for the production of cast-iron pipe. R. B. Carr is secretary.

BESSEMER—The Imperial Pipe Co., manufacturer of cast-iron pipe, will make extensions and improvements in its plant to increase production about 50 per cent. Facilities will be provided for the employment of 50 additional men.

BIRMINGHAM—The United States Cast Iron Pipe & Foundry Co., 71 Broadway, New York, will soon commence enlargements in its local plant for considerable increase in capacity. Considerable new machinery will be installed, including equipment for the de Lavaud process of cast-iron pipe production. The company is also planning for extensions in its foundry at Burlington, N. J., for the installation of similar machinery.

California

SAN FRANCISCO—The Los Angeles Soap Co., 633 1st St., Los Angeles, manufacturer of soaps, washing powders, etc., has awarded a contract to H. N. McClure, San Francisco, for excavation for its proposed new plant at 2nd and Brannan Sts., to be 2-story and basement, estimated to cost \$80,000. Work will be placed under way at once. Other contracts for erection will be let immediately. W. H. Crim, Jr., 425 Kearny St., San Francisco, is architect.

PITTSBURG—The Columbia Steel Corp., San Francisco, has awarded a contract to the Union Construction Co., Key Route Fill, Oakland, for the erection of five new buildings at its local plant, estimated to cost in excess of \$150,000, inclusive of equipment. Work will be placed in progress at once.

Colorado

DENVER—The Producers' & Refiners' Corp., California Bldg., is planning for the immediate construction of a large oil-refining plant in the vicinity of its present works at Greenville, Wyo. A new pipe line, pumping plants and other structures will be built. A stock issue of \$7,500,000 has been arranged, a portion of the proceeds to be used for the expansion.

Connecticut

BRIDGEPORT—Jenkins Brothers, Inc., 80 White St., New York, will install a new foundry in connection with additions to its local plant for the manufacture of valves and other kindred engineering products, to be equipped for cast-steel and cast-iron production heretofore secured from outside plants. The extensions, with equipment, will cost approximately \$250,000. The company is arranging for a bond issue of \$1,000,000, the expansion appropriation to be taken from this fund. Lockwood, Greene & Co., 101 Park Ave., New York, are engineers. Bids will be called at once.

Delaware

NEW CASTLE—The Wilmington Fibre Specialty Co. has acquired the fiber plant of the Johns-Manville Co., Lockport, N. Y., and will remove the equipment to its local plant. Enlargements will be made in the New Castle works to accommodate the expansion, including the installation of fiber-making machinery rolling machines and auxiliary equipment. The work is estimated to cost about \$190,000. John W. Morris is president.

Florida

TAMPA—The Tampa Gas Co. is planning for extensions and improvements in its artificial gas plant to cost about \$200,000, including equipment.

JACKSONVILLE—William Nusbaum has arranged for the establishment of a local plant for the production of sisal fiber products. It will be operated under the name of the Cordova Hat Co.

Georgia

VALDOSTA—The Walker-Wood Products Co., manufacturer of turpentine, etc., has

plans under way for extensions in its plant, to include the installation of additional equipment.

SYLVESTER—The Tomlinson-Haddock Co., Albany, Ga., has acquired a local tract of land and plans for the installation of a local plant for the production of turpentine. The initial still capacity will be extended at an early date.

Idaho

PRIEST RIVER—The Spokane Soap Products Co., Spokane, Wash., manufacturer of soaps, washing powders, etc., has concluded negotiations for a local site and plans for the early erection of a new plant.

Illinois

OTTAWA—The National Plate Glass Co., General Motors Bldg., Detroit, Mich., affiliated with the Fisher Body Co., same address, manufacturer of automobile bodies, has acquired a tract of land of about 200 acres at Ottawa, adjoining the plant of the Federal Plate Glass Co., a subsidiary organization. Plans are under way for the erection of a new plant, to be operated under the Federal name, with capacity of close to 15,000,000 sq. ft. of polished glass per annum, practically doubling the present works capacity. The buildings with machinery are estimated to cost approximately \$5,000,000. L. P. Fisher is vice-president of the National company.

MT. VERNON—The Mt. Vernon Car Mfg. Co. has preliminary plans in progress for the rebuilding of its foundry, recently destroyed by fire. The new structure will cost approximately \$25,000. Neller, Rich & Co., 431 South Dearborn St., Chicago, are engineers.

CHICAGO—L. A. Malchor, formerly connected with the Oxweld Acetylene Co., will commence the immediate erection of a new 1-story welding plant at 2613-17 State St., estimated to cost approximately \$25,000, including equipment.

CHICAGO—The Detroit Copper & Brass Rolling Mills, 111 North Jefferson St., have purchased property at Washington Blvd. and Ada St., 50x170 ft., for a consideration of about \$42,000. The site will be used for the erection of a new plant in the near future. Construction will be deferred for several months, owing to existing property leases.

Indiana

INDIANAPOLIS—The Indianapolis Terra Cotta Co., 1241 Consolidated Bldg., is considering plans for the erection of a new plant at Roosevelt and Olney Sts. George H. Lacy is general manager.

INDIANAPOLIS—The National Malleable Castings Co. has filed plans for the erection of an addition to its plant at Holmes and West Michigan Sts.

SEYMOUR—The Silverstone Stucco & Plaster Products Co., 220 Indiana Pythian Bldg., Indianapolis, is taking bids on a general contract for the erection of its proposed new local plant, the first unit to be 1-story, 50x96 ft. Merritt, Harrison & Turlock, 500 Board of Trade Bldg., Indianapolis, are architects. L. M. Briggs is secretary.

Kansas

WICHITA—The Derby Refining Co. is planning for additions in its local oil-refining plant to increase the present output about one-third. The rated capacity is 5,000 bbl. per day. The work is estimated to cost approximately \$300,000, including machinery.

LEAVENWORTH—The Bonner Portland Cement Co. is having plans prepared for extensions in its plant to cost approximately \$1,500,000, including machinery. Headquarters of the company are in the Victor Bldg., Kansas City, Mo.

Kentucky

LOUISVILLE—The Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., manufacturer of sanitary ware, has tentative plans under consideration for the erection of a new addition to its local pottery on Shipp Ave., to be 2-story and basement, 125x500 ft. The company recently completed an extension to the works.

Maryland

BALTIMORE—The United States Asphalt Refining Co., Fairfield Rd., Wagner's Point, will install a number of new steel tanks and auxiliary equipment at its plant.

NORTH EAST—The North East Porcelain Co., recently organized, has acquired a local

works, previously used for porcelain manufacture, and will establish a new plant. The structure will be remodeled, and extensions and improvements made, including the installation of new machinery. It is expected to have the plant ready for service early in April. E. Kirk Brown, Charles A. Ferguson and J. Wesley McAllister head the company.

BALTIMORE—The Standard Oil Co. has completed plans for the installation of additional steel tanks and auxiliary equipment at its plant at 1st Ave. and 3rd St., to cost about \$30,000.

Massachusetts

NEW BEDFORD—The New Bedford Gas & Edison Light Co. will install experimental machinery at its artificial gas works for the manufacture of gas from crude oil. The equipment will replace the retorts heretofore used. It is expected to install additional apparatus of the character noted at a later date.

Michigan

BATTLE CREEK—Phillip Ruxton, Inc., 220 West 42nd St., New York, manufacturer of printing inks, has acquired the local plant of the F. A. Rigler Ink Co., and plans for the early erection of a large addition to the plant to double, approximately, the present capacity.

DETROIT—The Unique Brass Mfg. Co., 123 Military Ave., is planning for the rebuilding of the portion of its plant, destroyed by fire, Feb. 5. An official estimate of loss has not been announced.

MONROE—The Monroe Paper Co. has awarded a contract to August Radtke, 528 South Smith Ave., for the rebuilding of the portion of its plant recently destroyed by fire, estimated to cost about \$50,000. Leonard Mitchell is manager.

DETROIT—The Schroeder Paint & Glass Co., 119 Cadillac Sq., has construction under way on a new 4-story plant at 12th and Antoinette Sts., 125x195 ft., estimated to cost approximately \$300,000, including equipment.

Missouri

WEST PLAINS—The National Rendering Co., 5th St. and the Kaw River, is completing plans and will soon commence the erection of a new local plant for reduction service, with departments for the manufacture of tallow and kindred products, estimated to cost about \$25,000. W. R. Ross is president.

Montana

LEWISTOWN—The Gordon Campbell-Kelvin Syndicate is planning for the organization of a subsidiary company, with capital of \$1,000,000, to construct and operate an oil refinery and topping plant. A site for the proposed refining plant is being selected in the vicinity of Seattle, Wash., while the new topping plant will be situated near Spokane. A pile line will be constructed to the Kelvin oilfields of the parent organization. Gordon Campbell is head of the company.

New Hampshire

PORTSMOUTH—The Bureau of Supplies and Accounts, Navy Department, will take bids until Feb. 27 for furnishing and installing an annealing furnace at the local navy yard.

New Jersey

ROOSEVELT—Fire, Feb. 3, destroyed a portion of the local plant of the Armourt Fertilizer Works, with loss estimated at about \$75,000, including equipment. It is planned to rebuild. Headquarters of the company are at 209 West Jackson Blvd., Chicago, Ill.

BAYONNE—The Vacuum Oil Co., foot of East 22nd St., will erect a new building at its local refining plant to cost about \$110,000. Headquarters of the company are at 61 Broadway, New York.

BERKELEY HEIGHTS—The J. H. Stone Corp., manufacturer of cork insulation products, has tentative plans under consideration for the rebuilding of the portion of its local plant destroyed by fire, Feb. 6, with loss estimated at close to \$150,000, including machinery. The company also operates a plant at Port Colburn, Ont.

New York

LONG ISLAND CITY—The Atlas Novelty Co., 722 East 11th St., New York, manufacturer of celluloid and composition products, has acquired property at Hancock St. and Freeman Ave., Long Island City, quipment.

38x112 ft., as a site for the erection of a new plant. Plans will be prepared at an early date.

POTSDAM—Hollis W. Martin, Norwood, N. Y., is organizing a company to construct and operate a paper mill on site recently acquired on the Requette Rd. T. L. Tomlines, City Bank Bldg., Syracuse, engineer, has been commissioned to prepare plans for a 1-story plant, estimated to cost approximately \$100,000, with machinery. It is expected to call for bids at an early date.

WATERFORD—The Little Falls Fibre Co., Little Falls, is planning for the rebuilding of the portion of its local plant destroyed by fire, Feb. 9, with loss approximating \$50,000, including equipment.

North Carolina

WILMINGTON—The Seminole Phosphate Co., Goldsboro, N. C., has leased a building at the foot of Hanover St., Wilmington, for the establishment of a new plant for the manufacture of fertilizer products.

Ohio

RITTMAN—The Ohio Box Board Co., Wadsworth, O., is completing plans and will soon commence the erection of a new plant at Rittman, comprising a 1-story building, 110x800 ft., estimated to cost about \$200,000, including equipment for the manufacture of cardboard and boxboard products. Christian, Schwarzenberg & Gaede, Euclid Bldg., Cleveland, are engineers. E. J. Young is president.

LOWELLVILLE—The Republic Iron & Steel Co., Youngstown, O., has plans under way for the construction of a new byproducts coke plant addition, estimated to cost approximately \$5,000,000. The Koppers Co., Union Arcade, Pittsburgh, Pa., is engineer and contractor.

Oklahoma

OKLAHOMA CITY—The Dead Shot Chemical Co., 103 West Noble St., has preliminary plans under consideration for the rebuilding of the portion of its plant destroyed by fire, Feb. 3, with loss approximating \$75,000, including equipment and stock.

PONCA CITY—The Marland Refining Co. has tentative plans in progress for the construction of an addition to its local oil-refining plant, to increase the capacity from 12,000 to 15,000 bbl. per day. E. W. Marland is president.

Oregon

ASTORIA—The Union Oil Co., Mills Bldg., San Francisco, Calif., is planning for the construction of a new refining and distributing plant on local site, estimated to cost \$500,000, including equipment.

Pennsylvania

NEW CASTLE—The United States Steel Corp., Pittsburgh, Pa., has plans under way for additions and improvements in its local Carnegie works, including power and other equipment installation, estimated to cost in excess of \$500,000.

ALLENTOWN—The Lehigh Soap Works, Water St., has acquired factory property at Hanover Ave. and Sherman St., and will remodel the structure for a new plant. The present works will be removed to the new location. Enoch Painter heads the company.

YORK HAVEN—Fire, Feb. 8, destroyed a portion of the plant of the York Haven Paper Co., with loss estimated at about \$50,000. It is planned to rebuild.

PHILADELPHIA—The C. H. Boley Co., 3726 North Randolph St., manufacturer of chemical products, has awarded a contract to Charles H. Schaefer, Otis Bldg., for the erection of a 1-story plant addition, estimated to cost about \$15,000.

South Carolina

HARTSVILLE—T. H. Coker, Hartsville, is planning for the installation of a local clay-grinding plant for commercial kaolin production. Inquiries are being made for equipment for grinding 80 per cent fine, through a 100-mesh screen.

Tennessee

CHATTANOOGA—The Dixie Portland Cement Co. is arranging a program for extensions and improvements at its plant to cost about \$200,000, including additional quipment.

Texas

TEXAS CITY—The Texas Sugar Refining Co., lately formed with a capital of \$5,500,000, has been organized with Alexander Smith, of Peabody, Houghteling & Co., bankers, 366 Madison Ave., New York, as president. Plans for the proposed local refinery have been extended from a proposed investment of \$100,000 to one of close to \$1,000,000, including machinery. The works will consist of a number of buildings for an initial capacity of about 1,000,000 lb. of refined sugar per day, which will be increased in the future. It is purposed to have the first units ready for service before the close of the present year, giving employment to about 400 operatives.

West Virginia

PARKERSBURG—The General Porcelain Co. has tentative plans under consideration for the establishment of a new branch plant on site to be selected on the Pacific Coast. It is understood that preference will be given to a location in the vicinity of Portland, Ore.

CHESTER—The Cord Tire Co. has plans in progress for the erection of an addition to its plant to increase the output from 650 to 3,000 tires a day. It is estimated to cost in excess of \$125,000, with machinery.

New Companies

THE KESITE CHEMICAL CO., New York, N. Y., care of D. K. Shappiro, 276 5th Ave., representative, has been incorporated with a capital of \$25,000, to manufacture chemicals and chemical byproducts. The incorporators are H. Johnson, N. Kessel and W. T. Sandall.

THE SUSSEX CHEMICAL PRODUCTS CO., 169 Sussex St., Jersey City, N. J., has been incorporated with a capital of \$100,000, to manufacture chemicals and kindred products. The incorporators are Louis S. Hirsch, Paul B. Ducas and Edward Dreyfus.

THE HOLYOKE BRICK CO., Holyoke, Mass., has been incorporated with a capital of \$100,000, to manufacture brick, tile and other burned clay products. Patrick J. Kennedy, Jr., is president; and Henry H. Parsons, 69 Locust St., Holyoke, treasurer.

THE MIDWEST SUGAR REFINING CO., 326 Madison St., Chicago, Ill., has been incorporated with a capital of \$1,000,000, to construct and operate sugar-refining plants. The incorporators are John W. Davis, Arthur E. Dike and Ira H. McKinney.

THE AGO CHEMICAL CO., 1304 Fidelity Bldg., Baltimore, Md., has been incorporated with a capital of \$150,000, to manufacture chemicals, soaps and kindred products. The incorporators are A. J. Sherman, E. A. Hummer and J. C. Hamburger.

THE OPALESCENT PAPER CO., Providence, R. I., has been incorporated with a capital of \$150,000, to manufacture paper products. The incorporators are William H. Hamlyn, Sr. and Jr., both of Providence; and Harold C. Pearl.

THE H. R. JEFFERDS CO., New York, N. Y., care of J. I. Perry, 84 William St., representative, has been incorporated with a capital of \$52,700, to manufacture chemicals and rubber products. The incorporators are J. C. Treadwell and H. R. Jeffers.

THE CHEMICAL ENGINEERING CO., Cambridge, Mass., has been incorporated with a capital of 200 shares of stock, no par value, to manufacture chemical specialties and operate as chemical engineers. Porter O. Robinson is president; and J. Denison Kenyon, 8 Midland St., Worcester, Mass., treasurer. The last noted represents the company.

LEHMAN BROTHERS, INC., Jersey City, N. J., has been incorporated with a capital of \$50,000, to manufacture paints, oils, etc. The incorporators are David I. Goldstein, Hart and Earl Lehman, 22 Halladay St., Jersey City. The last noted represents the company.

THE ECONOMY OIL CO., Clarendon, Va., has been incorporated with a capital of \$200,000, to manufacture petroleum products. The incorporators are John Sallen and R. R. Allen, both of Clarendon.

THE PRISM SOAP & CHEMICAL CO., New York, N. Y., care of Samuel Falk, 291 Broadway, representative, has been incorporated with a capital of \$50,000, to manufacture chemicals, soaps and kindred products. The incorporators are J. Jordan, F. Mancuso and F. C. Battistella.

THE TEASDALE GLUE CO., Grand Rapids, Mich., has been incorporated with a capital of \$20,000, to manufacture glue, paste

and kindred specialties. The incorporators are John H. Nind, Jr., E. U. Kettle and Clyde H. Teasdale, 1517 Robinson Rd., Grand Rapids.

THE SPONGE RUBBER PRODUCTS CO., New Haven, Conn., has been incorporated with a capital of \$50,000, to manufacture rubber specialties. The incorporators are Frederick M. Daley, William R. Todd and Lowell Smith, all of Naugatuck, Conn.

THE R. D. BURCHARD CHEMICAL CO., St. Louis, Mo., has been incorporated with a capital of \$100,000, to manufacture chemicals and chemical byproducts. The incorporators are R. D. Burchard, J. W. Walsh and Benjamin M. Carriso, all of St. Louis.

THE UNITED STATES TURPENTINE CO., care of the Corporation Service Co., Equitable Bldg., Wilmington, Del., representative, has been incorporated under Delaware laws, with capital of \$5,000,000, to manufacture turpentine and affiliated products.

THE FRIEDLANDER SUPPLY CORP., 1212 Roosevelt Blvd., Chicago, Ill., has been incorporated with a capital of \$25,000, to manufacture chemicals, waxes, colors, etc. The incorporators are Samuel J. Friedlander, Charles K. Schwartz and Herbert Friedlander.

THE MASTER PRODUCTS CO., Newark, N. J., has been incorporated with a capital of \$75,000, to manufacture polishes for wood and metal work. The incorporators are Lorenzo A. Crowley and James Hilton, 99 Peshine Ave., Newark. The last noted represents the company.

THE DADE CITY BRICK CO., Dade City, Fla., has been incorporated with a capital of \$10,000, to manufacture brick, tile and other ceramic products. The incorporators are F. M. Ackerman, S. H. Ackerman and D. D. Faulkner, all of Dade City.

THE McLAUGHLIN PAPER CO., San Francisco, Calif., has been incorporated with a capital of \$100,000, to manufacture paper products. The incorporators are F. M. McAuliffe, Samuel B. Stevens and Jerome B. White, Nevada Bank Bldg., San Francisco. The last noted represents the company.

THE SINCLAIR & CARROLL CO., New York, N. Y., has been incorporated with a capital of \$100,000, to manufacture printing inks and kindred products. The incorporators are R. Bennett, P. G. Brennan and W. J. Ryan. The company is represented by Wing & Russell, 14 Wall St., New York.

THE ARTHUR DOVE CO., 5850 Forsyth St., Detroit, Mich., has been incorporated with a capital of \$50,000, to manufacture paints and enamels for industrial service. The incorporators are Fred W. Grundman, Henry P. Zapp and Arthur Dove, 3017 East Grand Blvd., Detroit.

THE L. H. HAMEL LEATHER CO., Haverhill, Mass., has been incorporated with a capital of \$50,000, to operate a local leather-tanning plant. Arthur A. Hamel is president, and Louis H. Hamel, 49 Lexington Ave., Bradford, Mass., treasurer. The last noted represents the company.

THE PATAPSCO OIL & GREASE CO., 109-11 Chesapeake St., Baltimore, Md., has been incorporated with a capital of \$50,000, to manufacture oils, greases and compounds. The incorporators are John and David L. Ryan, and Harry E. Parkhurst.

THE GENERAL FOUNDRY CO., Fort Worth, Tex., has been incorporated with a capital of \$25,000, to manufacture iron, steel and other metal castings. The incorporators are B. N. Wadley, R. A. and F. M. Stewart, all of Fort Worth.

THORNE & CO., INC., Elizabeth, N. J., care of Albert Ehinger, 653 Van Buren Ave., Elizabeth, representative, has been incorporated with a capital of 1,000 shares of stock, no par value, to manufacture chemicals and chemical byproducts. The incorporators are S. Reinhart, Irving Elserman and E. Horowitz.

Capital Increases, etc.

THE VICTORIA PAPER MILLS CO., Fulton, N. Y., has filed notice of increase in capital from \$100,000 to \$250,000 for general expansion.

THE STERLING BRICK CO., 5201 12th St., Detroit, Mich., has arranged for an increase in capital from \$25,000 to \$75,000.

THE JOHNSON OIL REFINING CO., 208 South LaSalle St., Chicago, Ill., has arranged for an increase in capital from \$2,000,000 to \$3,000,000 for expansion.

PRICE BROTHERS & CO., Quebec, Can., operating pulp and paper mills, is disposing of a bond issue of \$10,000,000, a portion of the proceeds to be used for expansion and general financing.

THE GORDON PETROLEUM CO., Eastland, Tex., has arranged for an increase in capital from \$150,000 to \$1,000,000 for proposed expansion.

THE HUDSON BRASS WORKS, INC., 16 Nassau St., Brooklyn, N. Y., has filed notice of increase in capital from \$150,000 to \$250,000 for expansion.

THE GEORGETOWN OIL CO., Georgetown, Del., has arranged for a change of name to the Union Oil Corp., at the same time increasing its capital from \$50,000 to \$300,000.

THE INLAND ENGINEERING CO., Chicago, Ill., has filed notice of change of name to the Standard Alloy Steel Co.

THE CONNECTICUT CHEMICAL CO., Hartford, Conn., has filed notice of dissolution under state laws. William H. Barnum, 111 Broadway, New York, is president and represents the company.

THE COLUMBIA STEEL CORP., San Francisco, Calif., with plant at Pittsburgh, Cal., a Delaware corporation, has arranged for an increase in capital from \$20,000,000 to \$110,000,000 for general expansion.

THE STANDARD SANITARY MFG. CO., Bessemer Bldg., Pittsburgh, Pa., manufacturer of enameled iron and clay products, a New Jersey corporation, has filed notice of increase in capital from \$20,000,000 to \$30,000,000 for general expansion.

THE OLBURY ELECTRO CHEMICAL CO., Harrison, N. Y., has filed notice of decrease in capital from \$1,500,000 to \$1,000,000.

THE GASKILL CHEMICAL CORP., 157 Spencer St., Brooklyn, N. Y., has filed notice of increase in capital to \$65,000.

Coming Meetings and Events

AMERICAN ASSOCIATION OF ENGINEERS will hold its annual convention in Norfolk, Va., May 7 to 9.

AMERICAN CHEMICAL SOCIETY will hold its spring meeting April 3 to 7, 1923, at New Haven, Conn.

AMERICAN ELECTROCHEMICAL SOCIETY will hold its spring meeting May 3, 4 and 5, 1923, at the Commodore Hotel, New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION will hold a meeting in Cleveland, O., April 28 to May 4.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS is holding its annual meeting in New York City this week.

AMERICAN LEATHER CHEMISTS ASSOCIATION will hold its twentieth annual convention at the Greenbrier, White Sulphur Springs, W. Va., June 7, 8 and 9.

AMERICAN SOCIETY FOR TESTING MATERIALS will hold its twenty-sixth annual meeting at the Chalfonte-Haddon Hall Hotel, Atlantic City, beginning Monday, June 25, 1923, and ending either Friday or Saturday of that week.

INTERNATIONAL CHAMBER OF COMMERCE will hold its second general meeting in Rome, Italy, March 19-26, 1923.

IRON AND STEEL INSTITUTE (London) will hold its annual meeting May 10 and 11 at the House of the Institution of Civil Engineers, London, S. W. 1.

NATIONAL FOREIGN TRADE COUNCIL has postponed its annual conference from April 25, 26 and 27, to May 2, 3 and 4. It will be held in New Orleans, La.

NEW JERSEY CHEMICAL SOCIETY holds a meeting at Stettens Restaurant, 542 Broad St., Newark, N. J., the second Monday of every month.

SOCIETY OF INDUSTRIAL ENGINEERS, with headquarters in Chicago, will hold its spring convention in Cincinnati, April 18, 19 and 20, 1923. The major subject will be "Management Problems of the Smaller Plants."

A PAPER INDUSTRIES EXPOSITION will be held in Grand Central Palace, New York City, during the week of April 9, 1923, by the International Exposition Co.

The following meetings are scheduled to be held in Rumford Hall, Chemists' Club, East 41st St., New York City: March 9—American Chemical Society, Nichols Medal; March 23—Society of Chemical Industry, regular meeting; April 20—Society of Chemical Industry (in charge), American Electrochemical Society, Société de Chimie Industrielle, American Chemical Society, joint meeting; May 4—American Chemical Society, regular meeting; May 11—Société de Chimie Industrielle (in charge), American Chemical Society, American Electrochemical Society, Society of Chemical Industry, joint meeting; May 18—Society of Chemical Industry, regular meeting; June 8—American Chemical Society, regular meeting.